MANUAL OF
EQUINE MEDICINE

GRESSWELL

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A MANUAL OF EQUINE MEDICINE.

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BACILLUS ANTHRACIS,

FROM CORRADO TOMMASI CRUDELI.

Fig 1.

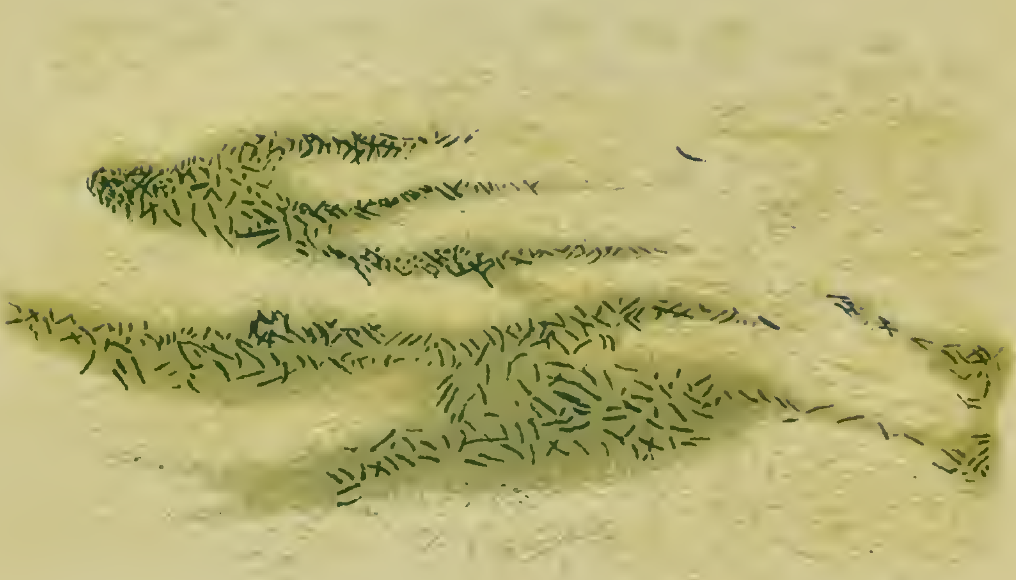

Fig. 1.—Vertical Section of a Malignant Pustule of Man, showing nests of Bacillus Anthracis in the tissues of the Skin. × 620 *diameters.*

Fig 2

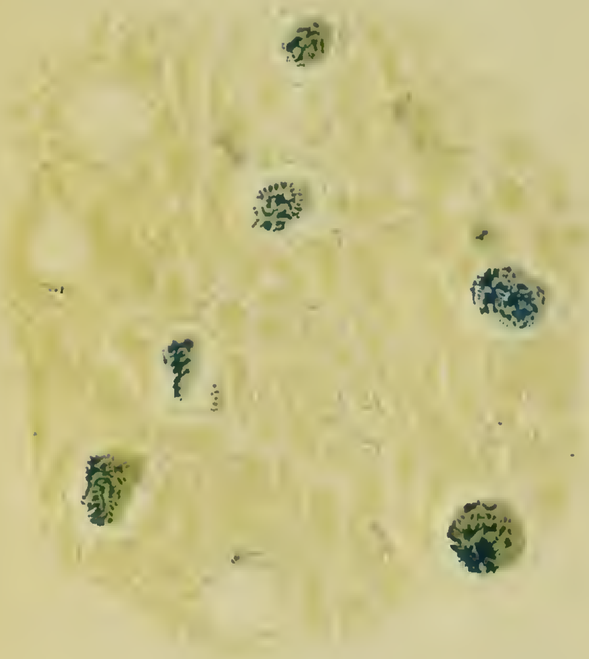

Fig. 2.—Section of Kidney of a Rabbit that died in consequence of carbuncular infection, showing accumulations of Bacillus Anthracis in the Malpighian Glomeruli and in the capillary network of the Kidney. × 90 *diameters.*

Fig 3

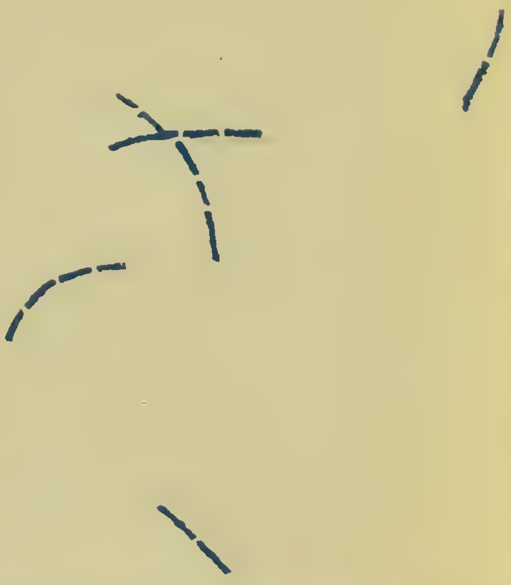

Fig. 3.—Bacillus Anthracis from Malignant Pustule × 1040 *times.*

BACILLUS ANTHRACIS.

From Corrado Tommasi Crudeli.

FIG. 1.

Fig. 1.—Transverse Section of a Malignant Pustule of Man, showing numerous [illegible] filaments in [illegible] of the Skin. × 300 diameters.

FIG. 3.

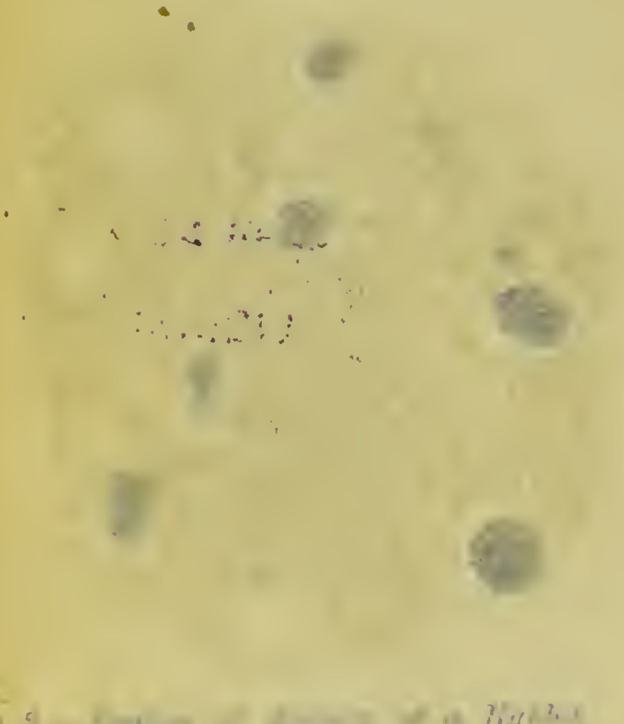

Fig. 3.—Section of Kidney of a Rabbit that died in consequence of carbuncular infection, showing accumulations of Bacillus Anthracis in the Malpighian Glomeruli and in the capillary network of the Kidney. × 90 diameters.

FIG. 2.

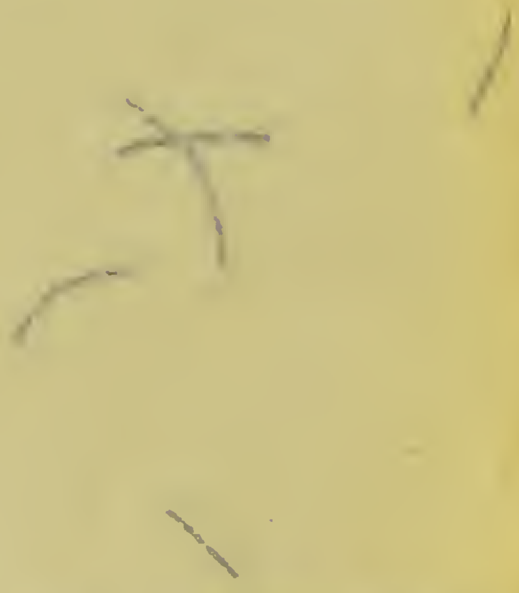

Fig. 2.—Bacillus Anthracis from Malignant Pustule. × 1000 times.

A MANUAL
OF THE
THEORY AND PRACTICE
OF
EQUINE MEDICINE.

BY

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ERRATA.

Page 195, in headline, *for* ' Diseases of the Respiratory Organs,' *read* ' General Diseases.'

Page 251, line 1, *for* 'Pleuritis, of Inflammation,' *read* 'Pleuritis, or Inflammation.'

Page 264, line 18, *for* 'chordæ tendinea,' *read* 'chordæ tendineæ.'

Page 267, line 15, *for* 'serous,' *read* ' venous.'

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THE RIGHT HONOURABLE

HENRY CHAPLIN, M.P.

THIS LITTLE MANUAL IS

Respectfully Dedicated,

AS A SLIGHT TOKEN OF ESTEEM TO ONE WHO,

AS A STATESMAN,

HAS DONE SO MUCH TO PROMOTE THE

INTERESTS OF AGRICULTURE;

AND IN GRATEFUL RECOGNITION OF PAST KINDNESSES,

BY

THE AUTHORS.

PREFACE TO THE FIRST EDITION.

In preparing the first of these Manuals of Veterinary Science, it has been our object to bring the chief facts of Equine Medicine and Pathology before the reader in as concise and clear a manner as possible.

It is our hope, regarding the many and great difficulties which are necessarily encountered in a work of this kind, that allowance will be made for errors of omission and commission which may be detected.

We have adopted a somewhat different classification of disease from that in vogue, and trust that its greater simplicity will entail less labour on the part of the student, without rendering it any the less scientific.

Throughout we have endeavoured to lay stress on those points which are of very great interest and importance from the point of view of the science of comparative pathology.

Into the histological structure of the malignant growths of the horse we have purposely not fully entered, it being our purpose to publish, as soon as opportunity arises, a monograph on the comparative pathology and etiology of the malignant growths in man and animals.

In the treatment of disease we have followed more especially the methods adopted by the late Mr. D. Gresswell, F.R.C.V.S., and those which practical experience leads us to consider of the greatest value.

We have appended chapters on Entozoa and Toxicology, as we consider both these subjects of great importance to the veterinary practitioner.

Veterinary Institution,
Louth, Lincolnshire.
November, 1884.

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Reynolds' 'System of Medicine.'
Robertson's 'Practice of Equine Medicine.'
Taylor on 'Poisons.'
Williams' 'Principles and Practice of Veterinary Medicine.
Wilson's 'Hygiene.'
A Paper by Dr. Seytter on 'The Horse.'

A MANUAL
OF THE
THEORY AND PRACTICE OF EQUINE MEDICINE.

INTRODUCTION.

In recent times Bacon's prophecies regarding the advance of science have indeed been fulfilled far beyond what even he could have imagined. Every day our knowledge grows, and as year follows year, the physician who makes it his aim to keep himself abreast of and conversant with the most important and wonderfully valuable work which is being done in nearly all parts of the world is acquiring new powers, hitherto undreamt of, in dealing with the ills with which human beings, in common with all animals, are liable to be subjected. If this is the case in reference to human medicine, as certainly is true, it is assuredly no less so in regard to the various branches of veterinary science.

Of the many great discoveries of modern science, none is so important as that which is called the 'Germ Theory of Disease.' The poison or virus of the numerous fevers which affect men and animals multiplies in a marvellously rapid manner, and hence they spread quickly by contagion and infection. Even so long ago as at the time of the Great Plague of London the belief was expressed that this pestilence was due to some living organism which entered the blood of man and multiplied therein, and that this poison was capable of passing from one person to others, either through the medium of the air, or by actual contact. Although, however, this inference from the facts of disease was made so long ago, it has only been in comparatively recent times that we have been enabled, by the aid of the microscope, to detect the real nature of the virus of fevers and other maladies. In the case of very many disorders, both of men and of animals, it has been conclusively proved, beyond all possibility of doubt, that the virus consists of very minute vegetable germs, which multiply in the body at an enormously rapid rate. By reason of the great disturbance they set up, they frequently occasion the death of the suffering patient. These germs are for the most part bacteria, bacilli, and micrococci, and they are of the utmost importance, since they are the actual and direct causes of innumerable diseases. Scarlet fever, anthrax or malignant carbuncle, cholera, small-pox, diphtheria, leprosy, consumption or tuberculosis, and many other infectious disorders, have all been proved to be due to the presence of different kinds of vegetal organisms in the blood and tissues. How very clear it is that all the knowledge which can be gained about these vegetal germs is of the most profound importance! Anthrax, a disease which attacks both man and animals alike, is very easily propagated. In the case of human beings, this plague is known as wool-sorter's disease, and also as malignant carbuncle. It has, moreover, been supposed to be identical with one of the plagues which were sent to punish Pharaoh and the Egyptians in the days of the captivity of Israel in Egypt. Now, the germ of this disease is called the Bacillus Anthracis, and numbers of these bacilli, which are little rod-like bodies, may be found to be present in the blood. These bacilli multiply by division, and when they are allowed to have free access to the air, bright oval spores make their appearance in them.

They may be best seen in a drop of blood (taken from a patient afflicted with anthrax) magnified so as to appear seven hundred times as large as they really are. The greatest possible care should be taken by the experimenter that he may not become inoculated.

With regard to the causation of tuberculosis, it was only a few years ago—namely, in 1882—that the bacilli which cause this dread malady were discovered by a physician of Berlin named Koch. In all cases of tuberculosis in man, cattle, and monkeys, this talented observer found the presence of peculiar fine bacilli, some provided with bright oval spores, some devoid of these spores, some smooth and of a homogeneous appearance, and others presenting rather a beaded look. These bacilli can be detected even at an early stage of the disease, by the use of the highest powers of the microscope, in the material coughed up by a consumptive person; and if these bacilli are seen to be present, it is absolutely certain that the person from whom they have been derived is suffering from this horrible malady. It seems that damp houses, damp countries, and damp clothing may favour the development of this disease which we are discussing. It seems also very probable that tuberculosis is communicated to human beings from cows through the medium of milk. In this connection it is to be observed that the whole qusetion of the transmissibility of diseases from animals to human beings is one of the profoundest significance. It does not appear to be the case that horses suffer in any marked degree from tuberculosis.

It seems that oxygen is favourable to the growth and activity of bacilli, whereas the more active allotropic modification of this gas, which is called ozone, appears to have a marked retarding effect upon them. Consequently, this latter agent, ozone, is of great value on account of its power of combating certain germ-diseases. Ozone has more active properties than oxygen, and possesses greater oxidising powers.

This is a point of the profoundest importance, especially in so far as human beings are concerned. However, we shall refer to the germ theory again more fully in its due place, and now proceed to a brief consideration of the natural history of the horse.

The Ungulata, or hoofed quadrupeds, comprise one of the largest natural orders of the Mammalia. These animals are divided into two sub-orders, the Perissodactyles and the Artiodactyles, according as the members of these two groups respectively possess an odd or an even number of toes on the hind-foot. Those hoofed animals which have an odd number of toes on the hind-foot are termed Perissodactyles (περισσος, odd, and δακτυλος, a toe), while those which are provided with an even number of toes are designated Artiodactyles (ἀρτιος, even, and δακτυλος, a toe). The Perissodactyles include the horse, tapir, and rhinoceros; while the Artiodactyles include the pig, hippopotamus, sheep, ox, camel, giraffe, and deer. This latter sub-order may be divided into two classes: the Ruminants, including the sheep, ox, camel, giraffe, and deer; and the Non-ruminants, which include the pig and hippopotamus. All the Ungulata feed upon vegetables, but the pig and the peccary are omnivorous animals. The placentation of the hoofed animals is non-deciduate, and in this point they agree with the order of the Cetacea. Moreover, they are always adapted for swift progression.

The sub-order Perissodactyla comprises, as we have above said, three living families, namely, the Tapiridæ or tapirs, the Equidæ or horses, and the Rhinocerotidæ or rhinoceroses. There are also several extinct families: the Macraucheniadæ (μακρος, long, and ἀυχην, neck); the Palæotheres (παλαιος, old, and θηριον, a beast); and the

Lophodontia (λοφος, a crest, and ὀδους, a tooth). The Perissodactyles are provided with no fewer than twenty-two dorso-lumbar vertebræ. They have a third trochanter on the femur, and the third digit of each foot is symmetrical. Horns, when present on the head of a Perissodactyle, are only skin-deep, are always placed on the middle line of the skull, as in the case of the rhinoceros, and they have no bony core. The number of toes in these animals is reduced to a minimum. The hind-foot of the tapir is provided with three well-developed toes, and these are homologous with the second, third and fourth digits of man. In the case of the rhinoceros all the feet have three toes, which are formed of the same three digits. In the horse the reduction is carried to its extreme, for that digit which corresponds with the third or middle digit of man is the only one which remains intact. There are, however, also two rudimentary digits, and these are called the splint-bones, and are homologous with the second and fourth digits of human beings. With regard to their distribution in past times, the Perissodactyles are first represented in geological strata of the Old World by the Lophodontia. Now, these extinct animals, which are met with in the Eocene strata of France and England, were very similar to the Artiodactyles. As in the case of the latter animals, their premolar teeth were simpler and longer than the molar teeth. However, the feet of the Lophodontia were of the Perissodactyle type. These Lophodontia were more like tapirs than any other now existing animals, and as we know, the tapirs are the most lowly differentiated of all existing Perissodactyles. Consequently the Lophodon is looked upon as representing the ancestral form of the modern Tapiridæ. As for the earliest representative of the rhinoceros, it is the Acerotherium which is met with in the Miocene strata of the Old World. The Palæotheres first occurs in the Eocene strata of Europe and North America. These animals varied in size from that of a roe-deer to that of a tapir, and their molar teeth resembled, in the pattern of the grinding surface, those of the rhinoceros. On the one hand they are allied with the horse and the rhinoceros, and through the Macraucheniadæ with the camels and tapirs. Palæotherium magnum was of the same size as a horse, while Palæotherium medium was of the same size as a pig. The animal called Eohippus is found in the Eocene strata of the Utah territory of North America. This extinct creature represents the earliest ancestral form of the horse. It was of about the same size as a fox, and its hind feet were provided with three toes, and its fore feet likewise with three. The Anchitherium appears in the early Miocene and late Eocene. This extinct animal was of about the size of a sheep. The Hipparion, Protohippus and Pleiohippus make their appearance in the early Pleiocene and late Miocene. These extinct animals were of about the same size as an ass. As for the Hipparion, it was a small, graceful animal, and had three well-developed toes, each of which was provided with a hoof. The middle toe was both strong and large, while the lateral toes were small, and did not extend beyond the fetlock. In this connection it is very interesting and noteworthy to find that cases are recorded in which horses have been born with a tridactyle foot in every respect similar to that of the Hipparion.

Now the Equidæ comprise several living species. They are divided into the true horses, which are provided with horny patches or callosities on the inner side of both pairs of limbs, above the wrist or the fore limb, and on the inner side of the metatarsus on the hind limbs; and the asses, which animals possess such callosities only on the fore limbs. With the asses we may also group the zebras and quaggas. The true horses are represented by one well-established species, Equus Caballus, and from this all races or varieties have descended through the gradual processes of natural and artificial selection. The different races vary as much as any two closely-allied species of wild animals do.

HISTORY AND GENERAL ACCOUNT OF THE HORSE.

Even in the very earliest times of remote antiquity, so far back as history, legend, or myth can lead us into the dusky and obscure epochs of the primeval existence of the human race, we find that the most noble, beautiful and swift of all terrestrial animals had received the attention of mankind.

So true is this, that even so long ago as eighteen centuries before the birth of our Saviour, Jesus Christ, the horse was known to the inhabitants of Babylon, who spoke of it, not as a recently discovered animal, but as one whose period of domestication had even at that early date been lost sight of in the misty vista of long-past ages.

This is shown by a stone tablet which was found by G. Smith among the ruins of the Assyrian city called Kounyoundjik. On another similar tablet, the date of which is not much more recent, and which was written in the reign of a certain king called Assur-bani-pal, there appears a fable which recounts how the horse and the ox entered into terms of friendship. The horse is referred to as the 'glorious in war,' a description which reminds us of the numerous Scriptural references to that animal.

It appears that no aboriginal or truly wild horse is positively known to exist, and it seems probable that the wild horse of the East may have descended from horses which had escaped from previous domestication. However, the wild horses of Tartary are doubtless the nearest living representatives of the stock from which our modern horses have arisen. These wild animals have a stripe along the back, and they are of a grayish drab colour. It appears, then, that there are grounds for supposing that the *tarpans*, or wild horses, which, with flowing manes and eyes flashing with piercing keenness, track the wide steppes of Central Asia, resemble in appearance that which the ancestors of our comparatively docile creatures must have presented, and are themselves the descendants of horses which escaped from domestication at the hands of some of the fathers of the human race.

The writer of the Book of Job (xxxix. 19-25) has bequeathed to us one of the finest characteristics of the war-horse, couched in the glowing language of Eastern metaphor: 'Hast thou given the horse strength? Hast thou clothed his neck with thunder? Canst thou make him afraid as a grasshopper? The glory of his nostrils is terrible!

'He paweth in the valley, and rejoiceth in his strength: he goeth on to meet the armed men.

'He mocketh at fear, and is not affrighted; neither turneth he back from the sword.

'The quiver rattleth against him, the glittering spear and the shield.

'He swalloweth the ground with fierceness and rage: neither believeth he that it is the sound of the trumpet.

'He saith among the trumpets, Ha, ha; and he smelleth the battle afar off, the thunder of the captains, and the shouting.'

In the 'Rigvêda,' *i.e.*, one of the sacred books of the Hindoos, the horse is mentioned as being in the service of man, and in the 'Iliad' of Homer the same animal is repeatedly alluded to.

Now, with regard to the origin of the name 'horse,' the following points are of importance:

The English word *horse* is derived from the form *hors*, used by the Anglo-Saxons before the Norman conquest. This word is the same as the Icelandic word *hors* or *hross*, and it is found, with very slight modifications, in most of the Teutonic languages. Thus we find *ros* in Dutch, and *ross* in the German tongue.

Now all these similar words are derived from an old syllable *hor* or *har*, of which the meaning is *running*, or *moving swiftly*.

There was another word in the language of Anglo-Saxons, i.e., *horsc*, which means *swift*, or *quick*. From this word *horsc* our English *rash*, and the German word *rasch*, both of which express the idea of swiftness, either of action or of thought, are derived.

Hence it appears that to the Teutonic race the horse was the animal whose chief and salient characteristic was its exceeding fleetness. Now we are not surprised to learn further that this same idea of swiftness, as the most distinctive point about the horse, occurs in various other languages of both Europe and Asia. For example, the Greeks called the horse *hippos* (*hikfos*), and the Latin name was *equus* (*eqvus*). Among the ancient Persians the word designating the horse was *açpa* and *asp*, and in the Gaelic language this same animal was termed *epos*. The Armenians call the horse *asb*, and the Lithuanians, a people who in ancient times lived along the shores of the Baltic Sea, used the word *aszwā*, which is merely a different form of the word *aihvus*, used by the ancient Goths. In the ancient language of India, such as is found in the sacred books of the Hindoos, *açva* means a horse; *âçus*, swift; and *açan*, a dart, or the swiftly-flying weapon.

Again, the word *aquila*, which is the Latin word for eagle, means the *swift-flyer*, and *aqua* is used for the quickly running waves of water, and also for water itself. With a slight change we find the same word also in the Keltic language as *achi*. The resemblance and connection between the two words *aqua* and *equus* respectively is of much importance.

The following notes on the word *horse* are taken from the *Veterinary Journal* for 1886, vol. xxiii., page 342 :

‘It is highly interesting to note that the word *horse* is very similar in all Aryan languages, thus showing us that this noble animal was domesticated on the table-lands of Bactriana at a pre-historic as well as a pre-Sanscritic period, when the Aryans still dwelt together.

‘The name in Sanscrit was *açva ;* Zend, *açpa ;* Persian, *asp ;* Armenian, *asb ;* Lithuan, *aszwa ;* Latin, *equus ;* Greek, ἵππος (derived from a primitive form ἵκϜος and ἵκκος, which was only preserved by the Æolians) ; Gaelic, *epos ;* Gothic, *aihvus ;* Old High German, *ehu.*

‘The primitive meaning of the word *horse* was “the rapid animal.” All other nations of pre-classical or classical date have no proper word for the horse, but borrowed the Aryan forms.

‘The art of riding was not known in high antiquity, horses only being employed for chariots. Riding is of more recent date. Greece was the home of equitation, which first originated in Thessaly (*cf.*, the myth of the Centaurs).

‘To the Greeks the art of riding was unknown before the year 500 B.C. At the time of the Grecian supremacy, we know that horses were used for the chariots, and about the year 450 B.C. we read of riding and of cavalry in Greece proper. If we turn to Roman history, we learn that in the early Regal times, and in the first centuries of the Republic, cavalry was the chief strength of the military armament.

'The word *ass* is purely Semitic in origin, and the word *pig* is Turanic (Egyptian).'

Now, we hope to show what these different, but very similar, names tell us. If we examine the written records of all the nations of the ancient civilization in the Old World in a direction from west to east, we find that the more we advance eastward the more markedly does the date of the first appearance of the horse as a domesticated animal glide back into the past, until it finally vanishes entirely from out of the memory of mankind into the uncertain and dusky regions of myth. Another observation, connected with the one just made, is that all the names of the horse handed down from the ancient races of mankind belong to the same stock of languages. No vestiges of an ancient name for the horse can be traced either in the great empires of the Nile, Egypt, and Meroë, or in the records of the Israelites, the Phœnicians, the Syrians, and the Arabs. Moreover, it is not only in going from west to east that the date of the domestication of the horse is removed back in time, for the same phenomenon is seen if we traverse India in a direction from south to north, and if we carry our inquiry along the territories of China and Mandshuria from east to west.

Thus it may be seen that we obtain three different lines or radii, beginning respectively in Western Europe—let us say on the West Coast of Ireland—in the South of India, and on the East Coast of Asia, and all running into one central point in the great steppe of Shamo or Gobi, in Inner Asia. Hence it appears clear that in this steppe must have been the first home of the domesticated horse, and that this beautiful animal must have spread from this place as a centre in concentric circles, and at different periods of time, to the furthermost parts of the earth.

On the boundless and dreary steppes of Central Asia still lives the wild horse called the *tarpan*, whose progenitors must in all probability have been the ancestors of our domesticated horse. As this untamed creature darts with flying mane and flashing eye across the spacious steppe, the animal appears to the savage nomad who inhabits those countries as a picture of all that is free, unfettered, and swift, fierce, agile, and independent. Therefore he has designated it the 'swift one'; and we in these days still call the animal by a name the derivation of which leads us to the same idea. We may remember that the swiftness of the *tarpan* is the more remarkable when it is compared with the wearily-moving and heavy-looking camel of Bactriana, with the tardy-footed ox, or with the timid sheep. Even the dog is but a poor creature in these countries, when it is compared with the horse.

Over the wild plains of Asia roam tribes whose very existence is dependent on the horse. The child of the Tartar is tied on the horse of its father and taught to ride, even before its legs are strong enough for walking. When adult, he eats and even often sleeps on horseback. Herodianus, an ancient writer, says in reference to one of these tribes of wild horsemen, the Parthians: 'They use their bows and horses not only for the purposes of war, like the Romans, but grow up with them from their earliest childhood. They never put their quivers aside, neither do they dismount their horses, but are always using them, either against their enemies or the wild beasts.'

In the valleys and deserts of the rivers Oxus and Jaxartes the Turkmenian horse is met with, and this animal is very highly esteemed on account of its strength, endurance, and intelligence. Provided only with but a small amount of food, the Turkmene rides for scores of miles, without once resting, over the waterless plains; and so swift are his actions, that he will surprise and rob his victim and then disappear, almost, as it were, before the person who is the object of assault realizes what has taken place. For his valuable qualities the rider loves his horse, in some cases, perhaps, even more than his wife and children, and takes the utmost care for the welfare of his steed. To the Kirghiz the horse is the ideal and quintessence of strength and beauty. 'He loves his horse more than his sweetheart,' says a modern traveller; 'and fine horses seduce even the most honest and honoured man to stealing.'

The best horses of olden times were those of Media and Persia, and the Medes and Persians were known through the length and breadth of the ancient world for their skill in horsemanship.

Herodotus speaks of the celebrated Nisæan horses: 'In Media there is a wide plain, the name of which is *Nisaion.* This plain produces the great horses called after it.' Another Grecian writer, the geographer Strabo, calls the Nisæan horses the best and greatest horses used by the kings of Persia. Another country also, Armenia, was renowned for its excellent breed of horses, as the same author tells us: 'Armenia is so blessed with horses that it equals Media in this particular. The satrap of Armenia sends to the king of Persia every year 20,000 young horses for the festival of Mithras.' Mithras was the sun-god of the ancient Persians, and the expression of this fact reminds us that the horse was sacred to solar deities among various nations.

The sun, moving quickly on across the cloudless skies over-arching the boundless and arid steppes of Central Asia, led the Medes and Persians, the Massagetes and Alanes, and numerous other tribes, to consecrate their steeds to their sun-gods. This fact we learn from the 'Father of history': 'They (the Massagetes) worship the sun as their god, and sacrifice horses to him. The meaning of this is that to the swiftest of all gods they sacrifice the swiftest of all earthly creatures.' In this connection we may remember that Homer speaks of the sun as being 'never tired.'

In the 'Rigvêda' of the Hindoos appear the following lines, descriptive of the horses of the sun-god :

'See Surja's blessed yellow coursers,
The praiseworthy and glittering in colours,
Rise worshipping on heaven's sphere ;
Round heav'n and earth they turn within a day.

'This is the godhead of Surja, his greatness ;
When all in action, he doth loose the team,
And when he from the chariot takes the yellow horses,
Still night is covering everything with darkness.

'And then, before the eyes of Mithras and Varunas,
Surja assumes his form in heavenly regions,
In endless train his red and dusky glory
Is led thus by his yellow coursers.'

The same idea of the sun-god riding in transcendent majesty in his magnificent chariot was also prevalent among the Greeks. Castor and Pollux, the two gods of light, are represented as riding on white horses, or standing on chariots drawn by them. In this guise they were said to have appeared in the battle which took place near the river Sagra, at which the Locri were aided and inspirited by their powerful assistance, and thereby rendered victorious over the men of Crotona. In the metaphorical language of antiquity it was said that white horses were wedded to the fair and beautiful daughters of Leukippos, whose name reveals the element of light. Eos, the rising sun, appears in the eastern skies mounted on white horses, which chase away the sombre shades of night before his radiant appearance. The Lacedæmonians sacrificed white horses to Helios on Mount Taygetus. This god, Helios, was represented as being drawn along by white horses, beaming in sweet and silvery radiance. Again, a white horse was sacred to Svatovit, the Slavonian god of light; and Triglav, the demon of night and all kinds of wickedness, who was the antagonist of Svatovit, is spoken of as riding on a black steed. The ancient Saxons, too, in like manner consecrated their white horses to the sun—a custom which clearly has the same origin as the sun-worship of ancient Persia, where Darius obtained the royal crown, because his horse neighed first to the rising sun.

The kings and heroes of ancient times were looked upon as the earthly representatives of the heavenly powers, and consequently the divine symbols were often also regal emblems. The citizens of Agrigentum, in Sicily, went out of their city with three hundred chariots drawn by white horses to meet the victorious hero Exænetus; and similarly the dictator Camillus, after having captured the proud city of Veji, entered Rome in triumph seated on a chariot drawn by white horses.

However, the horse was not only looked upon as a simile for the golden sun, but it was also supposed to represent the rapid storm, and also the swiftly-flowing water of rivers and seas.

In Greek mythology the horses of Boreas, the god of storms, form an important feature. We read in the 'Iliad' of Homer how the twelve foals of Boreas—

> '. . . . o'er the teeming cornfields as they flew,
> Skimmed o'er the standing ears, nor broke the haulm ;
> And o'er wide Ocean's bosom as they flew,
> Skimmed o'er the topmost spray of the hoary sea,' etc.

When the old Grecian writers wished to give a good description of a fine horse, they likened it to the storm or to the breeze. Thus 'the horses of Rhesus were in their swiftness like the winds.' Similarly, the steeds of Achilles were called the sons of Zephyr; and the Harpy *Podarge*, whose own name means the 'swift-footed,' possessed horses which flew with the gust of the wind; and one of them, called Xantheus, concerning this celerity boasts :

'Our speed of foot may vie with Zephyr's breeze,
Deemed swiftest of the winds. . . .'

Æolus, the ruler of the winds, is himself a son of Hippotes, *i.e.*, the horseman. Note these lines from Milton's 'Lycidas':

'And sage Hippotades their answer brings,
That not a blast was from his dungeon stray'd,
The air was calm, and on the level brine
Sleek Panope with all her sisters play'd.'

As depicted in the magic and mysterious twilight of Scandinavian mythology, the horse is the servant of various gods. Odin is the god of the fleeting, ever-moving, and either stormy or severe element of the air and the sky. Wuodan is the mighty lord of the wild chase of the German folk-lore. At the head of a spectral host, mounted on his horse, he rushes impetuously right through the forest, and the green leaves wave to and fro vehemently by reason of his onset, and the wind sweeps after him with a blast of fury as he speeds along over the still moonlit glades of the solitary and deserted pine-clad scenes. We still keep the recollection of the name of the potent hunter Wuodan in our *Wednesday*, *i.e.*, the day of Wuodan—this god, who possessed a giant horse, Sleipnir by name, provided with eight feet, and gray in colour, like the mist, and the fog, and the air of a midnight storm of wind and rain, whilst the moon rides high and vainly tries to pierce the gloomy atmosphere which covers the surface of the earth like a pall.

Winter, the giant, promises the gods of Völpusheim (*i.e.*, the Scandinavian Olympus) to build them a beautiful palace, in which undertaking he is assisted by his horse Svadilfari, or the North Wind. However, before the building is completed Loki, full of cunning and craft as he is, assumes the form of a steed (South Wind), and thus draws away Svadilfari's attention from the palace, which thus remains still unfinished when gay Spring comes. Thor, the terrible thunderer, dashes the head of the giant to pieces by means of his magic hammer.

We find the horse represented as a symbol of water in the beliefs of various nations. The ancient Persians killed horses in honour of the rivers, and we read that when Xerxes came to the river Strymon, the Magi sacrificed white horses to the genius of that river.

In like manner, during the reign of the Emperor Tiberius, the Parthian Tiridates propitiated the river-god of the Euphrates by means of the sacrifice of a horse.

Among the old Trojans the same rite prevailed. They threw living horses into the river Skamandros, and the hero Achilles tells us how

> '. . . . living horses in his waters sink.'

On the Argivian coast, in Greece, a well of fresh water is said to have in ancient times sprung forth amidst the waves of the salt sea. This spring was called *Dine,* and into it the Argivians formerly were wont to precipitate caparisoned horses as a sacrifice to Poseidon, the god of the sea.

In the island of Rhodes the inhabitants used to throw even whole chariots with their teams, all beautifully adorned and harnessed, and consecrated to Poseidon, into the sea.

The waves of the ocean, sweeping so gently over a sandy shore, or else dashing furiously with fierce vehemence against steep and rugged rocks, have been from the oldest times compared with horses. Indeed, if we watch the incessant game of the rolling waves, with their spray-topped crests of foam looking like silvery white manes and curved like the necks of restless and spirited horses, now sinking and now again rising, we shall assuredly see much appositeness in their being likened to the fabulous *horses of Poseidon.*

The employment of horses in the calm and peaceful pursuits and avocations of everyday life was not known in primitive times. Whenever we meet with the horse among the nations which existed in ancient days, it is always in the capacity of an animal suitable and used for warlike purposes. The horse drew the battle-chariot or bore the saddle (albeit that the art of riding is of much more recent date than that of driving), but it was never yoked to the plough or the cart. On the contrary, the ox was formerly the animal used for the tilling of the ground and the ordinary traffic.

> 'First of all a house, and a wife, and a ploughing ox.'

According to Hesiodus these are the three requisites for a rustic home, and it is very noteworthy that he does not add the horse. He who had no oxen or cart might try to borrow them from a neighbour; but

> 'Easily sayest thou, "Lend me two oxen, friend, and the chariot."
> But easy, too, the refusal, "The oxen are out at the work."'

The life of the ox, as being the support of man's existence, was looked upon as well-nigh sacred—almost as the life of his master was also valued. Pythagoras wrote:

> 'Lay not thy hand to the ploughing beast.'

In the fable of Cleobis and Biton, which Solon tells King Crœsus, it is said that the priestess of Hera drove an oxen-cart to her temple. The older Merovingian kings went to the assembly of the people on carts drawn by oxen; and by the provision of the Salic Law the killing of the *taurus regis*, or ox of the king, was punished by a much higher fine than was the slaying of the king's finest horse (*varannio regis*).

No such laws were made in regard to the horse, which animal was sacred to the war-god and to solar deities. The horse was either slaughtered on the altars of the temples, or else fell in battle.

Riding was not known to the ancients. On the ruins of the royal cities of Babylon, Assyria, and Media, the horse is always represented as engaged in drawing the chariot, and never as carrying a rider on its back. In the 'Iliad' we read that—

'In the front rank, with chariot and with horse,
He [Nestor] placed the car-borne warriors ; in the rear,
Numerous and brave, a cloud of infantry,
Compactly massed, to stem the tide of war.'

It is only in a more recent period of history that the saddle was first used. In the early times of Rome, cavalry was famous, and the Roman knights (*equites*, from *equus*) derived the name by which they were designated from that of the horses which they rode. Macaulay writes that Aulus, the Roman dictator,

'Spake to Caius Cossius,
The captain of his guard ;

* * * *

"Now hearken, Caius Cossius !
Spring on thy horse's back ;
Ride as the wolves of Apennine
Were all upon thy track."'

As time rolled on, and the dim glimmer of the heroic ages gradually waned away, as the bright sunny light of civilization began to shine upon this world of ours with all its brilliant lustre, when war and the pursuit of the chase and other like habits ceased to be the only avocations of mankind, and agriculture and the industrial arts began to take their place, then the horse was by degrees used more and more for the purposes of man's domestic life. No longer was the ox the only animal used for such objects. The horse was now employed to draw the plough through the soil, and was yoked to the peaceful cart which carried the productions of the soil to the market of the primitive town. As a servant of war, however, the horse still remained a prominent feature of the feudal institutions of the Middle Ages, and the orders and devices of chivalry could not have been what they were without the steed of the manly warrior and the noble knight. At the present time the use of the horse, so far as warlike purposes are concerned, is very much eclipsed by its importance in connection with the works and the numerous industries which are carried on in the piping times of peace.

To us, inhabitants of Europe and citizens of this nineteenth century, the horse is only serviceable on account of its intelligence and bodily strength. However, among various tribes of Central Asia, the Tartars, the Calmucks, the Mongols, and also the Turks and Huns in times of old, the milk and the flesh of the horse were, and still are, the main support of their existence. Cumiss, *i.e.*, fermented horses' milk, is considered to be the finest drink among the wild horsemen of the great Shamo in the heart of Asia. By such savage tribes of Turanian origin the custom of drinking the milk of horses was introduced among the old Slavonian populations, the Russians, the ancient Prussians, and the old inhabitants of the Baltic provinces of Russia. An old writer says of the ancient Prussians : 'They possess so much honey that the king and the rich people leave the mead to the poor and the serfs, and drink the milk of steeds.'

Here, as also among the ancient Medes and Persians, the steeds were kept in herds like cows, and were regularly milked. The Goths in Sweden, and the Sembes, a people inhabiting the country of Samland, used to intoxicate themselves with the fermented milk of horses.

Eating horse-flesh was a chief characteristic of the old invaders of Northern and Central Europe. Hordes of the yellow and dismal Huns invaded and laid waste the countries on the Danube and the whole of the German Empire at the beginning of the Middle Ages. These people used to put a piece of raw horse-flesh under their saddles, and ride on it until it was soft enough to be devoured. Cooked horse-flesh was in ancient times a favourite dish in

Germany, and even the pious inhabitants of convents and cloisters greatly enjoyed a joint of horse-meat, as may be inferred from the Latin blessing in use about 1000 A.D. among the monks of the rich convent of St. Gall in Switzerland: 'Sit feralis equi caro dulcis in hac cruce Christi' ('Let the sweet flesh of a wild horse be on this cross of Christ').

Pope Gregory III. wrote in the year 732 to Winifred Bonifacius, a Briton, and the great missionary and martyr of the North, called the Apostle of the Germans: 'Thou hast permitted to some the eating of the flesh of wild horses; henceforth, most holy brother, do not permit it any more.' It seems that the great British missionary had been lenient in this respect. Most probably he had been accustomed to the eating of horse-flesh in the time of his youth, and looked upon the practice as a natural one, and not with horror, as did the Pope, who lived in the South, where people were always more particular in regard to their choice of animal food than were the inhabitants of more northern climes.

Before we complete this sketch of the history of the horse, by a brief account of its existence in England, we propose to consider the two nations of ancient Egypt and of the Israelites, in so far as their relationship with that animal is concerned. In the ancient empire of Egypt, that is, from the beginnings of history to about the year 2,000 B.C., no mention whatever is made of the horse in the written records, nor is there any appearance of that animal in the pictorial representations.

It is only after the time when the great invasion of the Hyksos or Shepherd tribes into Egypt was past, viz., about the year 1700 B.C., that we find the horse included in the picture-writings of that wondrous country. Hence it seems probable that the horse was introduced into Egypt by the

Hyksos. At any rate this animal came from the East, and soon after its importation it became one of the most conspicuous possessions of the country.

In reference to the horse, there is a marked and singular absence of detail in the Scriptural accounts of that animal. The ox, the sheep, and the goat, are all much more particularly described; but concerning the horse we read but little except in so far as that animal is connected with war. In the olden times of Israel scarcely any mention is made of the horse, and it is merely referred to as forming the proud and insolent boast of the rich and mighty nations surrounding the humble and righteous people of the Lord. The patriarchs never used the horse for their own peaceful purposes, and, indeed, that animal seems not to have taken any part in the wanderings and struggles of the twelve tribes before and during their establishment in Palestine. Indeed, the ass and the mule seem to have been the only animals employed in riding and driving. The tenth commandment tells us: ‘Thou shalt not covet thy neighbour’s house, thou shalt not covet thy neighbour’s wife, nor his servant, nor his maid, nor his ox, nor his ass, nor anything that is his.’ The horse is not included in this enumeration, and from this omission further evidence may be derived that that animal was not an inhabitant of the land of Canaan at about the time of the Israelitish conquest. The horse is first mentioned in the Bible at the time of the Egyptian famine, and at that period the animal was probably very similar to the Arabian horse of the present day. This is shown not only by evidence from the sacred writings themselves, but also from the sculptures and paintings which still remain to remind us of the departed glories of Egypt and Assyria. It is noteworthy that the first mention of the horse in the Scriptures refers to it as an Egyptian animal. It seems that from the land of Egypt the horse penetrated into Palestine, in which country the animal had, as we have said, previously been unknown.

During the terrible famine, the occurrence of which Joseph had prophesied, the Egyptians and the inhabitants of neighbouring countries were unable to obtain either food for themselves or fodder for their cattle. We read: 'And they brought their cattle unto Joseph, and Joseph gave them bread in exchange for horses and the flocks, and for the cattle of herds, and for the asses, and he fed them with bread for all their cattle for that year.'

From the earliest times referred to in the records of history, horses were employed in chariots for purposes of war. In Exodus xiv. 6, we read that Pharaoh made ready his chariots to pursue the Israelites, and in a later part of the same chapter that six hundred of the Egyptian chariots accompanied their master in the pursuit, and that the whole army was delayed because the loss of the chariot-wheels made them drive heavily. At a much later date the iron chariot was used against the Israelites by Jabin, and we read that he, by means of his nine hundred chariots of iron, 'mightily oppressed the children of Israel' for twenty years. These weapons were greatly dreaded even by those who were accustomed to use them. This fear of them is exemplified by the fact that when the Syrians had besieged Samaria, and had nearly reduced the country by means of starvation, sounds supposed to have been made in the night-time by a host of chariots and horses caused the Syrians to seek safety in flight and evacuate the camp, leaving their booty and all their possessions in the hands of the Israelites.

It is not quite certain whether the Jews ever employed the terrible scythe-chariots, though it is probable that they may have done so. This conjecture is strengthened by the fact that these chariots were employed against the Jews by Antiochus, who possessed 'footmen an hundred and ten thousand, and horsemen five thousand and three hundred, and elephants two and twenty, and three hundred chariots armed with hooks' (2 Macc. xiii. 2).

Some commentators suppose that by the iron chariots ordinary chariots armed with iron scythes projecting from the sides were meant. We read in Psalm xx. 7, that 'some trust in chariots, and some in horses : but we will remember the name of the Lord our God.' The chariots were objects of almost superstitious fear, and the rushing sound of their wheels, the noise of the horses' hoofs, and the shaking of the ground as the 'prancing horses and jumping chariots' (Nahum iii. 2*) thundered along, are repeatedly alluded to in the Old Testament history.

Gradually the chariot came to be used for peaceful purposes, and to be employed, as are our carriages of this present day, to carry persons of wealth. The form and character of these chariots are made known to us by the sculptures and paintings of Egypt and Assyria, from both of which countries the Jews procured the vehicles. They appear to have been nothing but semicircular boxes mounted on wheels, and of very small size. There were two wheels but no springs. Two horses were generally used with each chariot, though three were sometimes employed. Sometimes the owner drove his own chariot; but the more usual plan was to have a driver, who managed the horses, while the other occupant could fight with both hands free.

As was the case with the chariot, so also the war-horse was not employed by the Jews until a rather late period of their history. In the days of David we first find mention made of a mounted force as forming part of the Jewish army. After that time the successive kings possessed large forces of cavalry. The chief arms of the Jewish soldier were therefore the cuirass, the helmet and the lance, the weapons found in all ages and in all countries to be peculiarly suitable to the horse-soldier.

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* 'The noise of a whip, and the noise of the rattling of the wheels, and of the prancing horses, and of the jumping chariots.'

In the former days of Israel and Judah, the horse was even looked upon as an abomination, as being an animal sacred to 'strange gods.' We read in 2 Kings xxiii. 11 as follows: 'And Josias took away the horses that the kings of Judah had given to the sun at the entering in of the house of the Lord . . . and burnt the chariots of the sun with fire.' These horses and chariots were evidently the emblems of some Eastern solar deity, perhaps Median or Assyrian. The armies of the heathens possessed horses and chariots. We read in Josh. xi. 4, that 'they [the Canaanites] went out, they and all their hosts with them . . . with horses and chariots very many,' and in Judges v. 22 that: 'Then were the horsehoofs broken by the means of the prancings.'

As the proud, lofty, and defiant animal of the mighty powers, the horse is mentioned in the Book of Job.

These prejudices against the horse were thrown aside in the course of time, and in the reign of King Solomon the kingdom of Israel was so thoroughly reconciled with the horse that a lively traffic was carried on with Egypt.

The Arab horse is also a comparatively recent importation from the East. The Arabs of the primitive times, strange as it may seem, did not know the use of the horse, and in the strength and swiftness of this animal consisted the might of their enemies. The Arabs themselves used the dromedary instead of the horse.

'In Arabia Felix' (now the province of Yemen in Arabia), says the geographer Strabo, 'there are neither horses nor mules to be found; their places are taken by camels.' Again, the Arab warriors in the army of Xerxes, and at a later period in that of Antiochus the Great, rode exclusively on dromedaries.

At the present day the Arab horse is one of the finest animals and the most precious jewel among the possessions of an Arab, who, like the Tartar and the Khirghiz, loves his horse far more than his family and himself. The following story is probably in some measure familiar to the reader, but still it will bear repetition :

'The whole stock of an Arab of the desert consisted of a mare. The French consul offered to purchase her, in order to send her to his sovereign, Louis XIV. The Arab would have rejected the proposal, but he was miserably poor ; he had scarcely a rag to cover him, and his wife and children were starving. The sum offered was great ; it would provide him and his family with food for life. At length, and reluctantly, he yielded. He brought the mare to the dwelling of the consul, dismounted, and stood leaning upon her. He looked now at the gold, and then at his favourite. What he said and to what conclusion he came may be quoted with the poem :

'"My beautiful ! my beautiful !
  That standest meekly by,
With thy proudly arched and glossy neck,
  And wild and fiery eye,
Who said that I had given thee up ?
  Who said I had thee sold ?
'Tis false ! 'tis false, my Arab steed !
  I'll fling them back their gold."

'With the last words he sprang upon his steed, and was presently out of sight.'

This particular breed of horses is well adapted for the purposes of war, being remarkable for the flexible agility of its movements, and the rider may guide the animal by the pressure of the knees and the voice, as well as by the bridle. Examples of a similar mode of guidance may be seen on the well-known frieze of the Parthenon, where in the Procession of Horsemen the riders may be seen directing their steeds by touching the side of the neck with one finger, thus showing their own skill and the good training to which the animals which they ride have been subjected.

The Arab horse is a singularly intelligent animal. The Arab lives with his horse, which will follow him about and come to him at his call, and stand still and wait for its rider. If he should fall off, the horse will stop and stand patiently beside him until he can remount, and an instance is recorded of an Arab horse, whose master had been wounded in battle, taking him up by his clothes and carrying him away to a place of safety.

The hoofs of the Arab horses are never shod, and even among the burning sands and hard rocks these beautiful animals tread with unbroken hoof. Indeed, in such a climate an iron shoe would be most injurious, as it would scorch the hoof in the day-time, and owing to the rapid change of temperature by day and night, the continued expansion and contraction of the metal would soon cause the nails to become loosened, so that the shoe would fall off. To this proud and noble animal of the sandy desert the splendid Spanish horse owes his excellence, and both the Spanish and the Arab horse have endowed the English racer and hunter with their exceptionally fine qualities of speed and endurance and beauty. It seems that all the thoroughbred horses found in England have, without exception, arisen from the Arab or the Spanish horse.

Now, turning to the question of the history of horses in Europe, and especially in England, we, in the first place, note that it was the horse that bore the countless hosts of Aryan settlers from the heart of Asia across two continents to the Ultima Thule of the ancient world, and probably without the aid of this animal that great immigration could not have occurred.

The first horses known in Europe are those of the geologic period known as the Neolithic Age. It seems very probable that they were used for food in this age, and that they were not at that time employed for riding or driving.

In the succeeding or Bronze Age they were probably introduced from the steppes of Central Asia, and were then used for riding and driving, as is shown by the discovery of bronze bits.

The evidence at our disposal, furnished mainly by the horse-shoes which have been found in Roman and Saxon tumuli, leads to the conclusion that the equine race was originally represented in Great Britain by small ponies upwards of twelve hands high. The first animals which were crossed with this primitive race were those which were brought over from abroad by the different peoples which at various times invaded England—the Romans, the Danes, the Saxons, the Norwegians, and so forth. That the management of horses was well understood and practised in England in the time of Cæsar, is shown by the fact that that invader was opposed by cavalry, in addition to a force of four thousand chariots. Cæsar, too, is the first writer who mentions British horses, and he praised them as being powerful, well suited for the purposes of war, owing to their stature and training, and as being managed with dexterity.

To the early Greeks the art of riding was unknown down to the year 500 B.C. At the time of the Grecian supremacy, however, horses were used for the chariots, and at about the year 450 B.C. we read of riding and of cavalry in Greece proper.

Turning to Roman history, we learn that in the early regal times, and in the first centuries of the republic, cavalry was the most important part of the military armament.

It appears, then, that the Britons used horses for their chariots in their wars against the Romans, and representations of horses appear on some of the early British coins. This is a fact of some significance, inasmuch as it testifies to the importance in which the horse was held in those early times. After Britain had been invaded by the Angles, Jutes, and Saxons, the rearing and training of horses was very well attended to, and the horses of that period were perhaps the best in the whole of Europe. As for the saddle, it seems to have been first used in the early part of the seventh century. The old ballad of the 'Battle of Maldon' says, concerning Goderic, that he fled from the field on the horse which his master had ridden in battle.

So deeply impressed with the importance of horses was the early Saxon King Athelstan, who reigned 925 A.D., that he made an enactment prohibiting the exportation of horses; and the same monarch also introduced into England *running* horses from Germany, and also horses from Spain, with the view of improving the native breed, as they did. The victory of William the Conqueror at Hastings is believed to have been in great measure due to the superiority of his Norman cavalry; and the same monarch, after having ascended the throne of England, paid great heed to the rearing of horses. The Bayeux Tapestry shows that the boats of the invading army of William were full of horses. Each knight possessed two horses, one being a small hack suited for him to ride upon, when unequipped for battle, and the other his great war-horse, led by his squire. The nags were mere ponies, possibly descended from Roman or Grecian stock; but they were larger than the native ponies of Great Britain. The chargers, on the other hand, were under sixteen hands high, and probably something like our modern brougham-horses in point of build. One of the nobles who accompanied the Conqueror from Normandy, Roger de Belesme by name, Earl of Shrewsbury, imported some fine Spanish stallions for the purpose of improving his studs in Wales, and for a long time afterwards the horses from that part of Wales were celebrated for their swiftness. Spanish horses have an Arabian strain; but the earliest direct importations of Oriental horses—Barbs, Turks, Arabs, and Persians—were brought into England by the English warriors when they returned from the Crusades. They had been fascinated with the splendour and excellence of the horses of the Saracens, and it was no wonder that they should bring home some of these beautifully proportioned steeds. These horses were about 14½ hands high. Moreover, our English breeds were also improved by the importation of large-sized chargers from Normandy and Flanders, not only by the Anglo-Normans, but also by the Plantagenets and Tudors. Chaucer refers to this type of horse:

> 'For it so high was, and so broad and long,
> So well proportioned for to be so strong,
> Right as it were a steed of Lombardy.'

The object held in view by those who imported these strong horses was to provide powerful steeds suitable for the chase and the tournament, which latter chivalrous pastime commenced in England about sixty years after the Conquest, and gradually began to wane in Queen Elizabeth's reign. The gradual intermixture of the various breeds in England led to an increased average of height—viz., from a standard of about 11 hands to one of about 14½ hands.

King John paid much attention to the important subject of the breeding of horses for agricultural purposes, and, according to that able writer, Youatt, we are indebted to this monarch for our draught-horses.

King Edward III., too, improved the breed considerably by means of mixing with it Spanish and Arab mares and stallions, which he caused to be brought to these shores. As we have above implied, the splendid Spanish horse itself owes its great excellence to a connection with the Arabian stock.

From this time great attention and care were bestowed upon breeding, races were regularly established in various parts, and enactments were made by various sovereigns from time to time, in order to secure the greatest possible excellence. During the Protectorate of Cromwell, horses were imported into England from Morocco and the South-East, and by this means elegance of form and swiftness of speed were added to the stoutness which had hitherto characterized the English horse.

The original colour of the horse appears to have been a dun-brown.

In the reign of Queen Elizabeth the tournament began to decline in popularity, and the establishment of racing, conducted at first in private and afterwards in public, gradually pushed into the background this ancient pastime. In the year 1580, in this sovereign's reign, the Earl of Arundel first introduced into England vehicles for carrying people in, and this, together with the lessening of the amount of armour required in fighting, the neglect of the tournament, and especially the increasing favour extended to the racecourse, gradually led to the replacement of the ponderous charger by a lighter and more agile animal. It is probable that horse-racing may have been introduced into England by the Romans, since races held a prominent place in the games of the circus, and their jockeys (*cursores*) were, like their modern representatives, decked out with bright and gay colours, and frequently also, as at the present day, received immense rewards for success from their patrons. James I. took great interest in the turf, and he introduced into England a pure Arabian stallion. It was during his reign, also, that racehorses were first recognised as a distinct class. With a view to the improvement of British breeds, James I.'s Arabian, D'Arcy's White Turk, the Selaby Turk of the Duke of Buckingham, and the Morocco Barb of Lord Fairfax, were imported. It was about this time that Lord Harlegh lamented the fact of the diminution of the old English stock known as 'the great horse.' Hence in the next reign it was represented to Charles I. that the breed of powerful horses fit for the defence of the country was likely to disappear.

In the period preceding the Restoration the prize for the winners of the great horse-races was a silver bell, and it was Charles II. who replaced this with a cup, now the object of the ambition of the owner and the rider of the racehorse. The same monarch established the course at Newmarket, built a palace and stables there, organized the meeting at Datchet Mead, near Windsor, and imported a great many Oriental horses. It was to Charles II. that, in 1667, the Duke of Newcastle dedicated his book on horsemanship, and it was in great part owing to the teaching contained in that book, that the King and his courtiers sent out agents to distant countries to procure Oriental stallions and mares, Barbs, Turks, Persians, and Arabians. Hence the occupants of the royal stables were the finest horses in the world, and there is no doubt that the newly-arrived animals were mated with English-bred horses and mares, and especially with the descendants of the racing stock of James I.'s time. These latter imparted to their offspring their size, while the Oriental horses supplied fleetness of limb. The Duke of Newcastle considered the Barbary horses superior to the Arabian. The Barbary mares, which Charles II. gained possession of for the royal stables, were very splendid animals. As 'royal mares,' they form the foundation of the English Stud-Book, which, however, was not issued until George III.'s reign, in the year 1808, since which time a regular account has been kept of the thoroughbreds. Previously half-bred horses had constantly appeared on the turf; but since the institution of the *Racing Calendar* their appearance in flat racing has been and is exceptional. At the time when Charles II. ascended the English throne, the British racer was easily beaten by Oriental horses. These latter were, therefore, crossed with native horses, the new blood being rapidly introduced by the Turkish Barb and Arab sires. The progeny—partly from royal mares (themselves certainly not all true-bred Arabians) and partly from native English mares —was constantly crossed and recrossed, and hence arose the thoroughbred. The continued mingling of the improved stock brought still greater benefits, and the result was a very advantageous one. The English racer can now surpass the Arab courser.

It was in 1715, the year after George I.'s accession to the English throne, that Darley purchased of his brother, then residing in Aleppo, the celebrated Darley Arabian, the sire of Flying Childers, the fastest horse over a long distance ever known. In 1725, two years before the close of George II.'s reign, the Godolphin Barb, commonly called Arabian, was brought into England. From these two horses our most renowned racers have sprung. The Godolphin was bought in Paris from a person who had him in a water-cart, and whether he was a Barb or an Arabian is not known. At about the year 1750 the further use of Oriental blood and the in-and-in breeding which went on seemed to be disadvantageous. The experience of the next twenty years confirmed this view, and at about the close of the eighteenth century very few Asiatic horses were imported.

The successors of James I. down to Queen Anne, who died in 1714, thus completing the sovereigns of the House of Stuart, were all more or less strongly attached to the sport of horse-racing. In the reign of Queen Anne the York Plates were founded. Under George I.'s rule, the first sovereign of the House of Hanover, horse-racing became more and more popular, and during the remainder of the century it grew still more important. The two most celebrated horses of that period were Flying Childers, foaled in 1715, and Eclipse, foaled in 1764. These two horses for a long time sustained the reputation of being the fleetest horses that ever ran, and from the latter many of our best horses have descended. George IV., who reigned from 1820 to 1830, was devotedly fond of horse-racing. Owing to the powerful influence brought to bear upon the sport at all times, the special breed of racers was zealously fostered, and the 'thoroughbred' consequently became a very valuable animal, while all other breeds of horses in the country also necessarily partook directly or indirectly of the improvements attained to. The crossing which has gone on betwixt thoroughbreds and other horses has led to the production of good hunters, hacks, and carriage-horses; but of late this inter-breeding has not been practised sufficiently. During the close of the last century and the early part of this, the 'thoroughbred' was much utilized for the production of grand coach-horses, and hunters and hacks, distinguished by their powers of endurance, well suited to that hard-riding time. The result was that men of all views appreciated and encouraged the sport of racing, if not for its own sake, at least for the sake of the effect it had in bringing about the production of a breed of grand horses distinguished for their staying powers, a breed which reflected its value and lustre on all the breeds of horses in the country. The money now annually devoted to Queen's Plates was a direct bounty given by the nation for the purpose of encouraging the breed of horses and of evoking excellence.

The sport has gradually gained the gigantic importance which it possesses in these days as a consequence of the continued influence of the patronage of wealth and the aristocracy, and in great measure also it has been due to the natural love of sport ingrained in the hearts of all classes alike. Especially in the last fifty years has the love of the intense excitement of the betting-ring been added to the other factors at work; and this unhealthy impetus has led to the lessening of the distance, and consequently to an increased speed. Moreover, the demand has increased to such a pitch that horses are now trained at a very early age—indeed, before their constitutions are at all well set. The long-distance races do not admit of that intense and continued excitement which the gambling spirit fosters, and hence, for some time past, they have been replaced by races of a mile and five or six furlongs. Weight-for-age races have likewise gone down in favour; and foremost among these failures have been the contests for Queen's Plates. The diminution of distance and general substitution of handicaps for weight-for-age races, together with the immense sums of added money now given by modern proprietors of racecourses, have completely altered the aspects of the sport, and are rapidly changing the character and physique of the racecourse. Where in former days hundreds were given for races to be run in heats of miles, now thousands are given for one race of as many furlongs. The public demands this form of excitement; and so long as large gates will pay for it, undoubtedly it will be provided. It is, however, of great moment to note the changes in the horse which are taking place, and the effect of them on the other breeds of the country.

Many horsemen assert that we do not now possess such good horses as those of sixty years ago, and that none of our racers could run a six-mile course in as good form as they did 200 years since. During the last century most of the Royal Plates were given to six-year-old horses carrying twelve stone. Matured horses were raced over long distances. Afterwards, three-year-olds were brought out; but as they could not run the four-mile courses the distance was reduced, and then it was thought that two-year-olds might run, and the consequence of this was that the course was still further reduced, and now we have two-year-olds racing on a five-furlong course. The bones are not set, and the tissues of the body are not properly developed at this early age. For the two days preceding the Derby, Stockwell had not eaten an oat owing to the soreness of his gums, consequent upon early dentition. Of course, he failed. With a view to arrest the evil of early training, Admiral Rous suggested the institution of a national prize of £5,000, to be run for by four-year-olds or even older animals, over a long course of about three or four miles.

The distinctive features of the thoroughbred may be said to consist chiefly in a certain characteristic symmetry and proportion of build, and a great and striking beauty of form. The muscles, and especially, perhaps, the structures composing the nervous system, possess a powerful, yet delicate and fine tone, in virtue of which the animals have great powers of speed coupled with wonderful endurance over short distances. Possibly their staying qualities and fleetness may be due to an increased vascularity of the muscular and nervous mechanisms, or, perhaps, to a more general heightened vascularity. The effects of habitual use, the rapid and intense exertion to which they have, after a long period of careful breeding, gradually become more and more accustomed, together with high feeding and most careful selection for breeding purposes of the best survivors, may in some measure account for the exceptional qualities of the racer. The Arabian horses were, centuries ago, characterized by their speed, and this inherited power has been skilfully brought to a climax in these days by means of most careful breeding. Racing as it was formerly practised—viz., the running of matured horses over long distances—had very much to do with the gradual evolution of the racer. The early English racehorses of James I.'s time possessed the qualifications of superior size and of good proportion of locomotive parts, and to these advantages the Oriental horses added their own peculiar features of forehead, quick organs of sense, beauty and quickness of action, the nervous power, and perhaps a density of muscular fibre. The resulting animals are distinguished by their well-proportioned locomotive parts, by their inclined shoulders, their legs and joints accurately in proportion, their strong carcase, deep chest, and thighs well let down. It has been shown that the speed of the thoroughbred and his general characteristics depend on his improved vascularity, or the increased circulatory power of the blood. Consequently the extra speed demanded by this new order of things must be met by a still further increase in the size of the heart, the central pump of the circulatory system, and in the size also of the lungs. This gradually results in a condition of general enlargement of those organs and of the muscles generally, known scientifically as hypertrophy of them. It is possible that high feeding and the systematic attention to its health in the early life of the animal may render to some extent this state of things normal; but in many instances further changes ensue, known as degenerative changes, and these constitute organic disease. Already it is most common to find these changes, especially of the heart, a distinct feature in horses of four years old, and foals are born with the same tendency. Sufficient numbers of racers with the requisite stamina for long-distance races could not be bred to meet the demands of the time; and, on the other hand, the structural alterations of the horse itself render it totally unfit to revert to the old order of things. Improved in speed, as the racehorse undoubtedly is, yet, beyond a certain pitch, it is absolutely certain that liability to disease must advance in direct proportion with increase in speed. Thus many causes are at work to augment the value of the thoroughbred; viz., value of stakes, demand for greater number of races, greater speed required, and, finally, yearly advancing liability to hereditary disease of the heart. The sound survivor becomes more and more valuable, more isolated, and more out of touch with the ordinary breeds of hunters and carriage-horses of the country. In former days the services of sound thoroughbred stallions were at all times available for breeding purposes, as soundness was fairly assured by the severe system of training and racing, and the ordinary prizes of the turf were not of sufficient value to preclude the horse from the service of half-bred mares, when his racing career was done. Now, the racehorse, in consequence of his altered condition, is rapidly becoming an animal quite distinct from all other kinds, and when thorough soundness of heart and limbs survive, he attains a value quite prohibitive for ordinary breeding purposes.

The result is that those animals which are available for ordinary use are to a large extent unfitted for the purpose, by reason of unsoundness in wind or limb, or by reason of having lost their character upon the racecourse, on account of so-called cowardice, a direct result of those degenerative changes of the heart above alluded to. The percentage of horses sound but too slow for racing purposes is small, as this class is frequently operated upon with the view of its conversion into light-weight hunters. Increase of speed in racing beyond due limit is, therefore, gradually reducing the value of the racehorse as a general improver of the breed of ordinary horses.

It is frequently said, however, that the 'unsound travelling stallions' are somewhat of a myth, and that the public will take care of itself, and not use these unsound animals, if they do exist. Columns might be written to prove the fallacy of these sayings. Suffice it that in the general opinion of veterinary surgeons all over the country, and according to the practical experience of well-known dealers, it is acknowledged that all those diseases, admittedly of an hereditary character, have been largely on the increase during the last ten or fifteen years. Foremost among these are bony enlargements upon the legs, and in connection with important joints, such as splints, spavins, ringbones, etc., ulceration, and wasting of a most important small bone in the centre of the foot, called the navicular bone, predisposition to diseases of the throat, such as roaring, and, finally, short-sight and long-sight, giving rise to shying. These formidable imperfections, any one of which seriously lessens the value of the subject of them, may be handed down from sire to offspring. They constitute the heaviest losses to the breeder; but at the same time all are possible of prevention to a large extent. To fully meet the objection that the ordinary breeder will not use sires so affected, it must be remembered that in many cases these diseases exist in a latent form, and are not always evident to an unskilled observer.

Allusion has also been made above to another, and perhaps most serious (because more hidden), disease of an hereditary character, namely, disease of the heart. This may truly be considered the most formidable, for it will readily be understood how all other unsoundness may emanate from it. Extraordinary development of the heart and blood-vessels to meet the demand for requisite speed entails an increased size in the blood-vessels all over the body. Granting that excessive development is peculiarly liable to degenerative change, it will readily be seen how failure in the action of the heart, and consequently in blood-vessels in any part of the body, may at any time cause one or more of the many unsoundnesses enumerated above. Thus, a sire may be without outward symptoms of unsoundness, recognised by an ordinary observer, yet be capable of transmitting any one of them. Yet this unsoundness of heart is one of the certain natural and positive results of our present system of racing.

For several years past it has been seen that the money devoted to Queen's Plates has been completely wasted so far as its original purpose is concerned. Racing has become so much a national pastime, and has grown so much in magnitude, that the importance of these prizes and their influence in support of racing have been completely swamped by the fortunes now added to races of much less severe character. For the support of racing in the old days, and the consequent preservation of a special class of highly-trained and carefully-bred animals which would improve the breed of horses generally, no doubt they were invaluable, and thoroughly served the purpose for which they were instituted. The Royal Commission on Breeding, however, was thoroughly satisfied that at the present time they served no useful purpose whatever, and recommended that the money be devoted to purposes bearing more directly on the improvement of horses. Inasmuch as it was seen that sound stallions, through the exigencies of training, and on account of their increased value as racing sires when sound, and their generally increased value, whether sound or not, are so difficult of attainment, the

Royal Commission saw no better method of dealing with the money formerly given to Queen's Plates than by offering the money as premiums to owners of thoroughbred stallions, to induce them to place their horses at the disposal of the public at a nominal fee. 'The objects of the present show, to be held this week in Nottingham,' wrote Mr. Charles Gresswell in that important and valuable paper, *The Nottingham Daily Guardian*, of February 7th, 1888, 'are to select absolutely sound horses of good stock to be located in fixed places throughout the kingdom. Every horse selected as the winner of a Queen's Premium will, after a most searching examination by the highest veterinary authorities, be guaranteed by the committee to be free from all hereditary disease. Undoubtedly this is a step in the right direction, and the end in view is quite possible of attainment, when we consider that the expensive and fashionable speedy blood of the day is not only not essential for the breeding of hunters and carriage-horses, but rather detrimental, inasmuch as it is certain to be accompanied by too highly developed organs of circulation, and, in some cases, latent diseases of these organs. Thoroughbred horses with plenty of bone and stamina, and free from all disease, though not speedy enough for present-day racing, will be found to get hunters and carriage-horses of as good quality as heretofore.

'The Committee of Management will have done their duty to the public if they find the sound sires. It will remain for the public to do theirs by bringing sound mares to them. Where formerly no security of soundness existed, probably less care was used in the selection of the mares; but no excuse will hold if each division of the kingdom to which these horses are appointed do not have next year a goodly crop of sound animals of which hunters or carriage-horses may be made, without the present risk that 30 per cent. may turn out screws. Racehorses will yearly be bred of greater speed, at an expense to their constitution at present but dimly realized; but amongst the breed there will always remain sound horses of stamina, though without electric speed, capable of guaranteeing the continued excellence of our half-breds; but the difficulties of selection will increase as the present system of racing continues. The Government, in conjunction with the Royal Agricultural Society, are taking the first steps in this laudable direction, and it is to be hoped, for the future benefit of our horses, that not only will every public stallion be guaranteed free from taint, but that the public will generally be alive to the fact (which has been over and over again proven), that in breeding "like produces like," and that a sound offspring can only result from a sound sire and a sound dam.'

Thus, in conclusion, it may be said that artificial selection by the hand of man, in addition to the natural selection always going on, has been of the very greatest importance in the production and establishment of the various breeds of horses.

It is, indeed, nothing less than astonishing to note how the forms of horses have been modified by the various conditions of life and so forth to which they have been subjected. As an example of this general statement we may point out, as is indeed well known to be the case, that horses which live in mountainous districts or in small islands become reduced in size owing to a deficient supply or a want of variety of food. This is, of course, only one instance out of very many which could be adduced of the strange and far-reaching effects of external conditions.

Those who love the horse should therefore strive to help to perfect that noble animal, so beautiful, so stately, so supremely useful as it is. Indeed, we cannot wonder that the minds and hearts of many of the best men in past times have been strongly drawn to the horse. In the pages which follow we devote our humble efforts to help all who read to understand the causes and the phenomena of those various diseases which are liable to afflict the horse. We hope we may in some degree have succeeded, and we wish it shall so be in the dim and perhaps far-distant future, that our work may be the stimulus to much better and much more perfect work at the hands of others who will follow us, to whom it may be given to help, in no small degree, mankind, the horse, and also all the animals which dwell upon this earth of ours.

SCRIPTURAL REFERENCES TO THE HORSE.

In the sacred pages of the Bible we find the following allusions to the horse:

Genesis xlvii. 17: 'And they brought their cattle unto Joseph: and Joseph gave them bread in exchange for horses, and for the flocks, and for cattle of the herds, and for the asses: and he fed them with bread for all their cattle for that year.'

Exodus ix. 3: 'Behold, the hand of the Lord is upon thy cattle which is in the field, upon the horses, upon the asses, upon the camels, upon the oxen, and upon the sheep: there shall be a very grievous murrain.'

Deuteronomy xvii. 16: 'But he shall not multiply horses to himself, nor cause the people to return to Egypt, to the end that he should multiply horses: forasmuch as the Lord hath said unto you, Ye shall henceforth return no more that way.'

1 Kings iv. 28: 'Barley also and straw for the horses and dromedaries brought they unto the place where the officers were, every man according to his charge.'

1 Kings x. 25: 'And they brought every man his present, vessels of silver, and vessels of gold, and garments, and armour, and spices, horses, and mules, a rate year by year.'

2 Kings ii. 11: 'And it came to pass, as they still went on, and talked, that, behold, there appeared a chariot of

fire, and horses of fire, and parted them both asunder; and Elijah went up by a whirlwind into heaven.'

2 Kings iii. 7: 'And he went and sent to Jehoshaphat the king of Judah, saying, The king of Moab hath rebelled against me: wilt thou go with me against Moab to battle? And he said, I will go up: I am as thou art, my people as thy people, and my horses as thy horses.'

2 Kings v. 9: 'So Naaman came with his horses and with his chariot, and stood at the door of the house of Elisha.'

2 Kings vii. 7: 'Wherefore they arose and fled in the twilight, and left their tents, and their horses, and their asses, even the camp as it was, and fled for their life.'

2 Kings vii. 10: 'So they came and called unto the porter of the city: and they told them, saying, We came to the camp of the Syrians, and, behold, there was no man there, neither voice of man, but horses tied, and asses tied, and the tents as they were.'

2 Kings vii. 13: 'And one of his servants answered and said, Let some take, I pray thee, five of the horses that remain, which are left in the city, (behold, they are as all the multitude of Israel that are left in it: behold, I say, they are even as all the multitude of the Israelites that are consumed:) and let us send and see.'

2 Kings ix. 33: 'And he said, Throw her down. So they threw her down: and some of her blood was sprinkled on the wall, and on the horses: and he trode her under foot.'

2 Kings xiv. 20: 'And they brought him on horses: and he was buried at Jerusalem with his fathers in the city of David.'

2 Chronicles i. 16, 17: 'And Solomon had horses brought out of Egypt, and linen yarn: the king's merchants received the linen yarn at a price. And they fetched up, and brought

forth out of Egypt a chariot for six hundred shekels of silver, and an horse for an hundred and fifty: and so brought they out horses for all the kings of the Hittites, and for the kings of Syria, by their means.'

2 Chronicles ix. 24 : 'And they brought every man his present, vessels of silver, and vessels of gold, and raiment, harness, and spices, horses, and mules, a rate year by year.'

2 Chronicles ix. 28 : 'And they brought unto Solomon horses out of Egypt, and out of all lands.'

2 Chronicles xxv. 28 : 'And they brought him upon horses, and buried him with his fathers in the city of Judah.'

Isaiah xxxvi. 8 : 'Now therefore give pledges, I pray thee, to my master the king of Assyria, and I will give thee two thousand horses, if thou be able on thy part to set riders upon them.'

Proverbs xxx. 15 : 'The horseleach hath two daughters, crying, Give, give. There are three things that are never satisfied, yea, four things say not, It is enough.'

Ecclesiastes x. 7 : 'I have seen servants upon horses, and princes walking as servants upon the earth.'

Isaiah ii. 7 : 'Their land also is full of silver and gold, neither is there any end of their treasures; their land is also full of horses, neither is there any end of their chariots.'

Isaiah v. 28 : 'Whose arrows are sharp, and all their bows bent, their horses' hoofs shall be counted like flint, and their wheels like a whirlwind.'

Isaiah xxx. 16 : 'But ye said, No; for we will flee upon horses; therefore shall ye flee: and, We will ride upon the swift; therefore shall they that pursue you be swift.'

Isaiah xxxi. 1 : 'Woe to them that go down to Egypt for help; and stay on horses, and trust in chariots, because they are many; and in horsemen, because they are very strong! but they look not unto the Holy One of Israel, neither seek the Lord!'

Isaiah xxxi. 3: 'Now the Egyptians are men, and not God; and their horses flesh, and not spirit. When the Lord shall stretch out His hand, both he that helpeth shall fall, and he that is holpen shall fall down, and they all shall fail together.'

Jeremiah iv. 13: 'Behold, He shall come up as clouds, and His chariots shall be as a whirlwind: His horses are swifter than eagles. Woe unto us! for we are spoiled.'

Jeremiah v. 8: 'They were as fed horses in the morning: every one neighed after his neighbour's wife.'

Jeremiah vi. 23: 'They shall lay hold on bow and spear; they are cruel, and have no mercy; their voice roareth like the sea; and they ride upon horses, set in array as men for war against thee, O daughter of Zion.'

Jeremiah viii. 16: 'The snorting of his horses was heard from Dan: the whole land trembled at the sound of the neighing of his strong ones; for they are come, and have devoured the land, and all that is in it; the city, and those that dwell therein.'

Jeremiah xii. 5: 'If thou hast run with the footmen, and they have wearied thee, then how canst thou contend with horses? and if in the land of peace, wherein thou trustedst, they wearied thee, then how wilt thou do in the swelling of Jordan?'

Jeremiah xlvi. 4: 'Harness the horses; and get up, ye horsemen, and stand forth with your helmets; furbish the spears, and put on the brigandines.'

Jeremiah xlvii. 3: 'At the noise of the stamping of the hoofs of his strong horses, at the rushing of his chariots, and at the rumbling of his wheels, the fathers shall not look back to their children for feebleness of hands.'

Jeremiah l. 42: 'They shall hold the bow and the lance: they are cruel, and will not show mercy; their voice shall roar like the sea, and they shall ride upon horses, every one put in array, like a man to the battle, against thee, O daughter of Babylon.'

Jeremiah li. 27: 'Set ye up a standard in the land, blow the trumpet among the nations, prepare the nations against her, call together against her the kingdoms of Ararat, Minni, and Ashchenaz; appoint a captain against her; cause the horses to come up as the rough caterpillars.'

Ezekiel xvii. 15: 'But he rebelled against him in sending his ambassadors into Egypt, that they might give him horses and much people. Shall he prosper? shall he escape that doeth such things? or shall he break the covenant, and be delivered?'

Ezekiel xxiii. 6: 'Which were clothed with blue, captains and rulers, all of them desirable young men, horsemen riding upon horses.'

Ezekiel xxiii. 12: 'She doted upon the Assyrians her neighbours, captains and rulers clothed most gorgeously, horsemen riding upon horses, all of them desirable young men.'

Ezekiel xxiii. 20: 'For she doted upon their paramours, whose flesh is as the flesh of asses, and whose issue is like the issue of horses.'

Ezekiel xxiii. 23: 'The Babylonians, and all the Chaldeans, Pekod, and Shoa, and Koa, and all the Assyrians with them: all of them desirable young men, captains and rulers, great lords and renowned, all of them riding upon horses.'

Ezekiel xxvi. 10: 'By reason of the abundance of his horses their dust shall cover thee: thy walls shall shake at the noise of the horsemen, and of the wheels, and of the chariots, when he shall enter into thy gates, as men enter into a city wherein is made a breach.'

Ezekiel xxvi. 11 : 'With the hoofs of his horses shall he tread down all thy streets : he shall slay thy people by the sword, and thy strong garrisons shall go down to the ground.'

Ezekiel xxvii. 14 : 'They of the house of Togarmah traded in thy fairs with horses, and horsemen, and mules.'

Ezekiel xxxviii. 4 : 'And I will turn thee back, and put hooks into thy jaws, and I will bring thee forth, and all thine army, horses and horsemen, all of them clothed with all sorts of armour, even a great company with bucklers and shields, all of them handling swords.'

Hosea i. 7 : 'But I will have mercy upon the house of Judah, and will save them by the Lord their God, and will not save them by bow, nor by sword, nor by battle, by horses, nor by horsemen.'

Hosea xiv. 3 : 'Asshur shall not save us; we will not ride upon horses : neither will we say any more to the work of our hands, Ye are our gods : for in thee the fatherless findeth mercy.'

Joel ii. 4 : 'The appearance of them is as the appearance of horses ; and as horsemen, so shall they run.'

Amos iv. 10 : 'I have sent among you the pestilence after the manner of Egypt : your young men have I slain with the sword, and have taken away your horses ; and I have made the stink of your camps to come up into your nostrils : yet have ye not returned unto Me, saith the Lord.'

Micah v. 10 : 'And it shall come to pass in that day, saith the Lord, that I will cut off thy horses out of the midst of thee, and I will destroy thy chariots.'

Haggai ii. 22 : 'And I will overthrow the throne of kingdoms, and I will destroy the strength of the kingdoms of the heathen ; and I will overthrow the chariots, and those that ride in them; and the horses and their riders shall come down, every one by the sword of his brother.'

Zechariah i. 8: 'I saw by night, and behold a man riding upon a red horse, and he stood among the myrtle trees that were in the bottom; and behind him were there red horses, speckled, and white.'

Zechariah vi. 2, 3: 'In the first chariot were red horses; and in the second chariot black horses; and in the third chariot white horses; and in the fourth chariot grisled and bay horses.

Zechariah vi. 6: 'The black horses which are therein go forth into the north country; and the white go forth after them; and the grisled go forth toward the south country.'

Zechariah x. 5: 'And they shall be as mighty men, which tread down their enemies in the mire of the streets in the battle: and they shall fight, because the Lord is with them, and the riders on horses shall be confounded.'

James iii. 3: 'Behold we put bits in the horses' mouths, that they may obey us; and we turn about their whole body.'

Revelation ix. 7: 'And the shapes of the locusts were like unto horses prepared unto battle; and on their heads were as it were crowns like gold, and their faces were as the faces of men.'

Revelation ix. 17: 'And thus I saw the horses in the vision, and them that sat on them, having breastplates of fire, and of jacinth, and brimstone: and the heads of the horses were as the heads of lions; and out of their mouths issued fire and smoke and brimstone.'

Revelation xviii. 13: 'And cinnamon, and odours, and ointments, and frankincense, and wine, and oil, and fine flour, and wheat, and beasts, and sheep, and horses, and chariots, and slaves, and souls of men.'

Revelation xix. 14: 'And the armies which were in heaven followed Him upon white horses, clothed in fine linen, white and clean.'

Revelation xix. 18: 'That ye may eat the flesh of kings, and the flesh of captains, and the flesh of mighty men, and the flesh of horses, and of them that sit on them, and the flesh of all men, both free and bond, both small and great.'

CHAPTER I.

ON THE CAUSES, SYMPTOMS, AND CLASSIFICATION OF DISEASES.

THE ÆTIOLOGY OF DISEASE.

By the word *ætiology* (ἀιτιος, a cause, and λογος, law) we mean the science of the causation of disease. It seems scarcely necessary to say that this science is of the greatest importance, and that it intimately affects all questions of diagnosis, prognosis, methods of treatment, and prophylactic measures.

We may, in the first place, say that the various causes of disease have been divided in different ways; as, for instance, into those which are said to be intrinsic and those which are extrinsic in character. Another grouping of them is that which places them in three classes; namely, the predisposing, the exciting, and the proximate. Those conditions are said to be predisposing which modify the health in such a way as to bring about a liability to become affected with that particular disease to the influence of which any human being or animal may be subjected. The exciting causes are those which directly impart disease. It may, however, be said that some of the causes which are spoken of as predisposing causes are in certain instances also exciting causes. Many local inflammations are no doubt directly due to exposure to variations of temperature and to changes in the hygrometric state of the atmosphere. The proximate causes of disease are those primary abnormal processes brought about by the exciting causes.

Dr. Bristowe illustrates this classification by the example of a woman who has often been exposed to the contagium of scarlet fever without becoming affected being again subjected to it at the time of childbirth, and then suffering from a severe attack. In such a case parturition may be said to be the predisposing cause, the scarlatinal virus to be the exciting cause, and the inflammatory processes going on in the skin, tonsils, and elsewhere, to be the proximate causes of many of the symptoms manifested.

We think that the question of the causation of disease is better considered under separate headings, although, perhaps, the distinction which exists between the predisposing and the exciting causes is of some value and convenience. The following points are noteworthy:

A. Age.—Certain diseases are particularly characteristic of older animals, whilst others are more liable to attack those which are young.

B. Sex.—The differences in the organization of the two sexes seem to bear not only a direct relationship, but also an indirect relationship, with the phenomena of disease. In addition to those diseases which are immediately connected with the special features of the generative organs of the two sexes, there also seem to be, especially in the case of human beings, certain forms of disease not as yet capable of being directly connected with those differences, which nevertheless seem to be more particularly liable to affect either males on the one hand, or females on the other, respectively. We may mention, as an example of this fact, that roaring is more commonly met with in horses and in geldings than in mares.

C. Personal Peculiarities.—In some cases a morbid condition appears during fœtal life, while in other instances a child is born healthy, but possesses a tendency to disease, which afterwards displays itself. In the case of human beings, nervous disorders, gout, tuberculosis, carcinoma, and other growths, are hereditarily transmitted, as also are many kinds of diseases of the skin. Offspring may inherit from their parents an actual disease, or, as is probably much more frequently the case, a special tendency to various forms of disease.

In this connection it may be said that the term *diathesis* is used to imply a special liability to contract or become affected with certain diseases. For instance, a man or an animal may have a susceptibility to rheumatism or to tuberculosis or other diseases.

D. Occupation, Quality of Food or Drink, Over-Indulgence or Privation.—All such factors have an important influence in regard to the causation of disease. For instance, work, when too severe, may induce disease, while an insufficiency of exercise may be equally injurious. Again, errors in regard to food and water are frequently sources of disease; for instance, when they are excessive or deficient in amount, or when they are unsuitable in point of quality. It is interesting to note that on those farms on which the water is hard we find that colic frequently occurs, and also that wens in beasts also seem to be connected with the ingestion of chalky water. Of course, it is well known that impure water is a source of divers diseases.

E. The influence of heat and of cold, of dryness and of moisture, and of atmospheric impurities, together with the question of sanitation, are certainly of very great importance. Sudden changes from heat to cold and from cold to heat may also be of much influence as factors of disease. Again, atmospheric or telluric changes may be connected with the causation of disease, and the localitv and the geological formation of the soil may also be considered. In this connection we may also point out that defective drainage and imperfect ventilation are important sources of disease. Indeed, it may be said that there is probably no more potent cause of disease amongst horses than an insufficient or vitiated supply of air.

F. Variety.—Some breeds of animals are more liable to certain diseases than other breeds. For instance, it has been found that navicular disease is rarely found in cart-horses, although it is a common affection among the more highly-bred animals.

G. Colour.—Melanoid sarcoma is frequently met with in gray or white, and also in chestnut-coloured, horses.

H. Temperament.—The sanguine temperament is especially a characteristic of highly-bred horses, whereas in lower-bred animals the lymphatic temperament is predominant. The sanguine temperament predisposes animals to diseases of an inflammatory type.

I. The Effects of Previous Disease.—Some diseases, when they have once been acquired, display a tendency to recur. As instances of this, we may mention rheumatism, pneumonia, bronchitis, tonsillitis, catarrh, inflammation of the kidneys, and intermittent hæmaturia.

A horse nearly always has a second attack of acute enteritis, if it once suffers from that complaint, and the second attack is generally fatal; and the same also holds in regard to lymphangitis, which latter disease may recur several times, and leave a permanently thickened leg. Similarly, a cow generally suffers from milk-fever several times, if it be afflicted with the disease once. Some acute fevers, however, may be of such a kind that a second attack seldom or never occurs. On the other hand, certain diseases are said to be in some degree protective against themselves.

J. Mechanical Causes.—(*a*) Exopathic mechanical causes include all forms of external violence. Injuries of various kinds may occasion much mischief. (*b*) Endopathic mechanical causes comprise mechanical obstructions of orifices or tubes, such as intestinal stricture, hernia, intussusception, and the lodgment of gall-stones, and all similar obstructions in the ducts of the liver and pancreas, in the various urinary passages, in the larynx, trachea, and bronchial tubes, at the cardiac orifices, and in the blood-vessels, impediments to the transmission of nerve-currents along the nerves, dilatation of arteries and of other tubes and cavities, perforations or ruptures of their parietes, and extravasations or effusions of blood, serum, and the like.

K. Chemical Causes include all poisons such as arsenic, antimony, and also vegetable poisons, such as the yew-tree, hellebore, and the rhododendron, etc. Most of these are of course exopathic.

Endopathic chemical causes are chiefly those which depend upon defective action of the excretory organs, and the consequent retention of effete matters which act as poisons. If the kidneys, the liver, the lungs, or the skin act inefficiently, grave disturbances may result. Its effects may also arise from the accumulation in the blood of the products of decomposition attending specific febrile disorders and so forth.

L. Vital Causes.—Of these we may first mention animal and vegetable parasites, and also the germs of the specific diseases. Animal parasites will be considered in detail in a later chapter.

Vegetable parasites are most potent sources of disease. When treating of Bacteria, we shall see that these vegetable fungi have been demonstrated in the blood and tissues of animals suffering from many diseases. As an example, anthrax or charbon will for the present suffice.

In addition, parasitic fungi are frequently developed on the external part of the body, producing definite disorders, but not invading the system at large.

The so-called tineæ are examples of such diseases. They are produced by the growth of parasitic fungi, such as the Trichophyton tonsurans and Achorion Schönleinii.

SEMEIOLOGY.

By semeiology (*σημειον*, sign, and *λογος*, law) we mean the science of the signs or symptoms manifested by the diseased animal.

Symptoms may be either local or general, according as they are restricted to a special part, or affect the system as a whole.

They are called primary, when they arise directly as a result of the disease; sympathetic or secondary, when arising from those caused by the primary disease, or from a secondary disorder.

They are called premonitory, when they precede the full development of the disease. Symptoms may be still further divided into diagnostic, prognostic, and therapeutic, according as they are respectively applicable to the distinction, the determination of the result, and the suggestion of the treatment, of the disease.

NOSOLOGY.

By nosology (*νοσος*, disease, and *λογος*, law) we understand the definition, the naming, and the classification of the diseases.

It is at present impossible to frame a perfectly natural classification of the diseases of man and animals, as our knowledge is inadequate for the purpose; but with the advance of medical science our system of classification will doubtless become gradually more and more perfect.

CHAPTER II.

GENERAL PATHOLOGY.

CONGESTION, OR HYPERÆMIA.

CONGESTION, or hyperæmia, is the name given to a condition in which there is excess of blood in the dilated vessels of any part of the body. It may either be active or arterial on the one hand, or mechanical or venous on the other.

Active Hyperæmia is excess of blood in the arteries of any part, generally accompanied by acceleration of the blood-flow. It is caused by diminished arterial resistance, which may be due to several causes, viz.:

1. Weakening or paralysing of the coats of the vessels.

2. Inhibition of the tonic action of the sympathetic on the walls of the vessels, which may occur either directly or reflexly.

As an example of the direct process, may be given the congestion occurring after section of the vaso-motor nerves, in any part of their course from their origin in the medulla oblongata, to the spinal or sympathetic plexuses.

Some drugs also, as nitrite of amyl, tobacco, and alcohol, probably directly paralyse the vaso-tonic nerves.

The reflex process is due to stimulation of afferent nerves. It is seen when food excites the flow of saliva or gastric juice.

3. Excitation of the vaso-dilator nerves, as, for example, the chorda tympani.

Mechanical or Venous Hyperæmia.—In venous hyperæmia the blood-flow is retarded, and the excess of blood is in the veins and capillaries.

Venous hyperæmia may be caused by—

1. Diminution of the force with which the blood should be driven through the veins.

2. Direct impediment to the return of blood by the veins.

We may consider these causes separately.

(1.) Diminution of the force of the circulation may be due to lessened cardiac power; for example, in the acute febrile disorders and in those degenerations of the cardiac structures which lead to dilation of the cavities.

In the arteries also the blood-current may be obstructed owing to morbid changes in their walls.

The current may also be obstructed in the capillaries, chiefly from the pressure of inflammatory effusions, dropsy, and other causes.

Finally, the flow may be impeded in the veins, owing to absence of muscular contraction of the walls, or to dilation of the vessels.

(2.) Direct impediment to the return of blood by the veins may be due to various causes.

As examples may be given the obstruction to the portal circulation which occurs in cirrhosis of the liver; the congestion of the lungs which occurs in mitral constriction and regurgitation; and that of the lower extremities which occurs from the pressure of the gravid uterus on the iliac veins.

The Results of Venous Congestion.—Venous congestion results in accumulation of blood, and diminished velocity of its flow in the dilated capillaries and veins. The most important changes which may follow are: transudation of serum, diapedesis of red blood-cells, hæmorrhage, fibroid induration, and frequently thrombosis. Gangrene, *i.e.*, death of the part, may result when the obstruction is very general and complete.

INFLAMMATION

May be defined as 'the succession of changes which takes place in a living tissue as the result of some kind of injury, provided that the injury be insufficient immediately to destroy its vitality' (Sanderson).

The phenomena of inflammation in vascular structures comprise—

1. Changes in the blood-vessels and circulation.
2. Exudation of fluid and blood-cells from the vessels.
3. Changes in the tissues affected.

(1.) **Changes in the Blood-vessels and Circulation.**—The first effect of inflammation is dilatation of the arteries. This dilatation steadily increases for about twelve hours, affecting chiefly the arteries, but also the veins. The capillaries are but slightly affected. The blood-flow becomes accelerated at first, and then in about an hour it becomes considerably retarded, though the vessels still remain dilated. Pulsation in the small arteries becomes manifest, and slowness of the stream allows of the distinction of individual corpuscles in the capillaries and smallest veins.

The acceleration of the blood-flow is not a constant occurrence, and often subsides without the appearance of the other phenomena of inflammation. The dilation, with diminished velocity, however, *is* constant, and is the essential vascular change in inflammation. As the blood-flow becomes retarded, white blood-cells gradually accumulate in the smaller veins, adhering to their walls, and some also stick in the capillaries.

Thus the lumina of the veins become narrowed by layers of white cells, among which there are no red ones; the circulation becomes slower and slower, and the red blood-cells, with some white ones, accumulate in the capillaries.

Eventually the blood-stream in the capillaries ceases, and the accumulated mass of cells moves to and fro with the pulse. This is the *stage of oscillation*, and it is followed by that of *stasis*, in which no movement of any kind takes place.

Finally, thrombosis may occur, when the capillary walls have lost all vitality.

(2.) **Escape of Fluid and of Blood-cells from the Vessels.**—Some of the leucocytes adhering to the sides of the vessels gradually sink into the walls of the small veins, and (to a less extent) of the capillaries, and pass through them. Red blood-cells also pass through, but to a far less extent. In severe inflammation, however, where the stagnation in the capillaries is extensive, red cells may pass through almost alone, and in large numbers, thus giving the exudation an hæmorrhagic character. The red cells pass out chiefly from the capillaries; the intensity of the inflammation and the vascularity of the tissues determining the proportion of them in the exudation.

The red and white cells at first remain near the vessels from which they have escaped, but are soon washed away by the exuding fluid, and the white cells move, in addition, by their own peculiar power of locomotion.

It is almost certain that all new cells formed in inflamed tissues, as a direct result of the injury which caused the process, are *escaped blood-cells.*

In the less acute forms of inflammation, cells are also formed by regenerative processes going on in the cells of the tissues; but these are not of inflammatory origin. The composition of inflammatory exudation is not constant. In the most acute inflammations it contains very many red cells; but in the less severe forms, white cells are in excess of the red.

The more severe the process, the more does the exudation resemble plasma in composition and character; while in the less severe forms it becomes more like the fluid exuded in mechanical hyperæmia.

(3.) **Changes in the Inflamed Tissues.**—Inflammation leads to depression of vitality, degeneration and death of the tissues involved. No increased vitality and no multiplication of tissue elements, form part in the process.

The essential lesion of inflammation is some change in the vessel-walls themselves. That these are affected is shown by the facts that all the early phenomena of inflammation are vascular, that injury of the vessels alone causes inflammation, and that injury of the tissues alone (Senftleben) does not cause them.

Furthermore, Ryneck has shown that stasis may be produced in the vessels of the web of the foot of the frog, in which milk or defibrinated blood is circulating in place of normal blood; and that no such stasis can be produced in vessels whose vitality has been destroyed by the injection of metallic poisons.

In all spontaneous inflammations the cause is first probably carried to the part by the blood, and acts firstly upon the vessels, and afterwards upon the tissues. There is no detectable structural alteration of the vessels, and so Cohnheim speaks of the change as molecular, and regards it as possibly chemical in nature.

Clinical Signs of Inflammation, and their Causes.—The clinical signs of inflammation are redness, heat, swelling, pain, and impaired function.

Redness and heat depend upon the amount of blood passing through the part in a given time. *Heat is not produced in excess* in the inflamed tissues.

Swelling arises from exudation of fluid and cells. It may be entirely due to fluid, as in hydrocele, or to cells mainly, as in orchitis, where the fluid has been absorbed.

Pain is due to pressure of the effusion on the nerve-endings, and perhaps also to chemical irritation of them. The more sensitive and rigid the tissue, and the more rapid the effusion, the greater is the pain.

Impaired function is due to the injury of the tissues involved.

VARIETIES OF INFLAMMATION.

The several varieties of inflammation are to be regarded simply as steps in the process, due to differences in

1. The resisting power of the tissue ;
2. The intensity of the cause ; and,
3. The duration of its action.

Serous Inflammation.—The best examples are chronic effusions into serous cavities, as the pleura, tunica vaginalis, or the joints. In impoverished states of the blood, especially when the albumen is diminished, inflammatory exudations are liable to be serous, even though the process be of considerable intensity. In serous inflammation the exudation contains excess of albumen, and but few white cells ; hence it does not coagulate, though a few flakes of fibrine may be formed.

If the process be more severe, the exudation contains more albumen, fibrinogen, and white cells; and hence fibrine forms in increasing quantity.

Networks of fibrine are of frequent occurrence in the meshes of inflammatory connective-tissue. These inflammations are termed sero-fibrinous.

Fibrinous Inflammation.—In this variety the exudation is still more richly albuminous, and contains more leucocytes. It has a much greater tendency to coagulate, and 'lymph' forms on the inflamed surface, or in the substance of the inflamed tissue.

The best examples of this kind of inflammation are those of serous membranes, the pleura for example. Here fibrine containing leucocytes is exuded, and is termed 'lymph.'

'Lymph' may form on both the visceral and parietal pleura, and the two opposed patches of inflammation may blend. This is the first stage in the formation of adhesions, *i.e.*, bands of connective-tissue between the two surfaces.

Lymph, similarly formed and composed of fibrine and leucocytes, is the temporary uniting medium in healing by first intention.

This form of inflammation may end in absorption.

Productive Inflammation.—Often the inflammatory process ends in the formation of new tissue, and is then termed 'productive.' In these cases the fibrine disappears from the exudation, and white cells crowd into it, converting it into a tissue of closely packed white cells, in a scanty homogeneous matrix, which is supplied by vascular loops springing from the capillaries of the inflamed tissue, penetrating it in all directions. This tissue is called *granulation-tissue.* The granulations, when plentifully supplied with newly-formed vessels, gradually become converted into connective-tissue, or *scar-tissue.*

This tissue is at first very vascular. Gradually the new tissue contracts, many of the vessels disappearing in consequence, and eventually the scar-tissue becomes less vascular than the surrounding parts.

Granulation-tissue may, however, 'break down into pus,' instead of forming scar-tissue. This is due to the insufficient development of vessels, diminution in their lumina, continuance of excessive irritation, and to the too dense packing of cells.

The term **interstitial** is applied to inflammations of solid organs where the connective-tissue is chiefly involved.

The term **parenchymatous** is applied to inflammations where the epithelial cells of the organs show the most marked changes.

Suppurative Inflammation.—Is a very common form.

In this variety the exudation contains the same elements as does the fibrinous exudation.

No coagulation occurs in this kind, no 'lymph' forms and vascularizes. Any 'lymph' which may be formed at an early stage is destroyed.

The irritation is more intense than that required to produce a fibrinous exudation, and its action is more prolonged.

Suppuration may occur in the tissues in a circumscribed form or abscess or in a diffuse manner, or its seat may be a free surface, as a mucous membrane or the skin. In the latter cases, when the epithelium is destroyed, with more or less of the subjacent tissue, the process is termed *Ulceration*, but when the deeper layers of epithelium remain it is termed a purulent catarrh.

Formation of an Acute Abscess.—Fluid and corpuscles escape into the irritated tissue. The cells accumulate especially round the small veins, which thus form commencing foci of infiltration. The infiltrations become denser and denser, and spread by migration and transportation of cells until the foci blend. In consequence of the extent of injury and succeeding nutritive disturbance, the tissue elements die and disappear before the leucocytes.

In the central parts of the diseased area no vessels are to be seen, and no new ones are formed.

From mutual pressure and absence of nutrition, the central cells die and degenerate together with the intercellular substance. Thus a cavity containing dead leucocytes (pus-cells) is formed, and it is bordered by still living infiltrated tissue.

The process gradually spreads by thrombosis of the vessels and consequent disintegration of the cells they supply. An acute abscess almost always extends until it bursts or is opened.

If the cavity be kept at rest and drained, the inflammatory cell-infiltration vascularizes, and the walls thus become lined by granular tissue.

This grows and stretches across the cavity, and then develops into scar-tissue. In this manner the abscess is healed.

Diffuse Suppuration is a similar process going on in a wider area.

Suppuration is characterized by the formation of *pus*, which from an otherwise healthy animal is thick, creamy, opaque, yellowish-white, and slightly viscid, and has a faint odour and alkaline reaction. The specific gravity varies from 1030—1033.

It contains about 10—15 per cent. of solid material, of which two-thirds are albumen, the rest being fatty matter and salts, such as are found in the blood. On standing, it separates into a clear supernatant fluid, called 'liquor puris,' and a dense yellow layer of pus-cells.

Pus-cells are spheroidal, semi-transparent, more or less granular motionless cells, usually containing a bi- or a tripartite nucleus. They are about $\frac{1}{2300}$ of an inch in diameter.

The more recently escaped cells perform amœboid movements, and have the appearance of leucocytes.

Ulceration.—Is due to the same molecular destruction of the tissue on a free surface as was described above. Commonly, shreds of disintegrated tissue adhere to the floor of a spreading ulcer. In more intense inflammation the shreds may become much larger, and are thus transformed into sloughs.

Ulceration passes insensibly into gangrene, when death becomes too rapid to permit of molecular disintegration of the tissues involved.

When the inflammation ceases, the round-celled infiltration on the floor becomes vascularized into granular tissue.

These granulations are bright-red rounded elevations, about the size of pins' heads, and consist of a group of cells round a capillary loop. They have no lymphatics or nerves, are not tender, and do not bleed readily.

Hæmorrhagic Inflammation.—This form is characterized by an exudation in which red blood-cells are in great excess. The greater the vascularity of the tissue, and the more severe the injury, the more likely is an exudation to be hæmorrhagic. In acute pneumonia, the exudation generally contains many red cells. This form of inflammation, too, often terminates in gangrene.

TERMINATIONS OF INFLAMMATION.

Inflammation may terminate in resolution, in necrosis, or in new growth.

1. **Resolution.**—This is the commonest and most favourable termination of inflammation. It consists in the cessation of the process, and the restoration of the parts to the normal condition.

The corpuscles of the stagnant blood gradually move away until the current is re-established in the inflamed area. Migration of cells and exudation of fluid ceases, and the circulation becomes normal. The exuded fluid and cells are removed firstly by the lymphatics, and afterwards by the veins also. The remaining blood-cells or fibrin undergo fatty degeneration and are removed.

2. **Necrosis.**—Inflammation may terminate in death of the implicated part. The more severe the injury, and the feebler the resistance of the tissues, the more likely is necrosis to occur. We apply the term 'necrosis' not to the molecular disturbance occurring in suppuration and ulceration, but to obvious death of tissue, and generally *en masse.* Some affections, *e.g.*, malignant pustule, always

terminate in necrosis or gangrene. Such inflammations are termed gangrenous or necrotic.

Diphtheritic is a special variety of necrotic inflammation. It affects the surfaces of mucous membranes and wounds.

In this form the mucous membrane is covered by a false membrane, composed of a network of fibrin, containing here and there leucocytes in the meshes.

The epithelium is quite destroyed, with more or less of the subjacent tissue. This form of inflammation characterizes the disease called 'diphtheria,' but a similar pathological change may occur on any mucous membrane, *e.g.*, that of the intestine (dysentery).

3. **New Growths.**—Inflammations ending in new growths are the so-called productive inflammations already considered.

ETIOLOGY OF INFLAMMATION.

Etiologically, inflammations are divided into simple or traumatic, and cryptogenetic.

1. **Simple or Traumatic Inflammations.**—Are due to some injurious agency, such as mechanical violence, action of chemicals, excess of heat or cold, or to prolonged local anæmia. Inflammation from these causes has no tendency to spread beyond the part originally injured, or to pass on to more advanced stages, after the causes have ceased to act. Under this heading come inflammations due to wet or cold, 'rheumatic' and 'reflex' influences.

Excessive functional activity is said by some to be a direct cause of inflammation.

Nervous influence is also regarded as a direct cause.

2. **Cryptogenetic Inflammations.**—In very many of the inflammations there has been no obvious chemical or mechanical injury. Many of these have been shown to be due to the action of various vegetable fungi, and evidence

has been given to show that the others are probably due to the same cause. These inflammations are termed cryptogenetic. The fungi may act as chemical or mechanical irritants, thus acting in the same way as the causes of simple inflammation. When the products of the life-action of these low vegetable organisms are irritant, inflammation results; the intensity of the process varying with the quantity and intensity of the irritant. If the irritation is intense, suppuration results; if it is less severe, the early stages of productive inflammation occur, as is supposed to be the case in farcy and tubercle. The characteristic lesion of these and some other diseases is an inflammatory nodule, raised round a spot at which the fungi have probably lodged, and whence they may spread and infect other parts. These lesions are spoken of as the 'Infective Granulomata,' the name signifying infective tumour-like formations of granulation-tissue (Ziegler).

Some fungi cannot live in healthy tissues; these are called 'non-pathogenic.' Of the others, which are called 'pathogenic,' some spread only by continuity of the tissues; others find a suitable nidus in lymph; whilst others enter the blood-stream, and are carried by it through the body (*e.g.*, Bacillus Anthracis). It is in this way that metastatic inflammations are to be explained; for example, the secondary abscesses of pyæmia, which constantly contain microbes, and the albuminuria, which so often complicates certain specific diseases.

The cryptogenetic inflammations are divided into the septic and the infective:

1. **Septic.**—Of non-pathogenic organisms, those which cause ordinary putrefaction are of much importance in inflammation.

The term **Septic** should be restricted to inflammations of this kind.

Often the discharges or sloughs from a simple wound, which has not healed by first intention and is not treated antiseptically, become putrid, and Bacterium Termo, and other organisms, especially micrococci, are found in them.

The products of the life of these fungi are the cause of the inflammation, and these organisms may continue to grow and excite fresh decomposition. If, however, the discharges are drawn off as fast as they are formed, the non-pathogenic organisms lose their pabulum and putrefaction ceases. Practically, if a wound be guarded from putrefaction, it is protected from infective organisms.

2. **Infective.**—Pathogenic organisms cause inflammation by penetrating into living tissues and causing irritant decomposition of the fluids. They are called infective because their poison multiplies in the tissues and spreads to near parts (locally infective), or distant parts (generally infective), in which they set up similar processes. Simple and septic inflammations are non-infective. The special peculiarities in the poisons cause special peculiarities in the inflammations, which are called 'specific' because they arise from specific causes.

THROMBOSIS.

By thrombosis we mean any coagulation of the blood in the heart, or vessels, occurring during life. The coagulum itself is called a thrombus, in opposition to a clot, the result of post-mortem coagulation. Thrombosis most commonly occurs in the veins. A thrombus may be distinguished from a clot formed after death by its laminated structure ; its greater amount of fibrin, which makes it more firm and light than post-mortem coagula ; its granular appearance on breaking ; the greater relative proportion of white blood-cells in it ; and by its firmer adhesion to the part with which it is in contact. In all cases where coagulation has been very rapid, the thrombus first appears on the lining membrane of the vessels, and slowly grows from without inwards by deposit of fresh fibrin, and thus finally blocks up the lumina of the vessels entirely.

It now extends in a direction towards the heart until it meets a current of blood strong enough to arrest its further progress.

CAUSES OF THROMBOSIS.—For the coagulation of blood three factors are necessary, viz., fibrinogen, fibrinoplastin, and the fibrin-ferment. Fibrinogen exists as such in the liquor sanguinis. The ferment and most of the fibrinoplastin are contained in the white cells, the destruction of some of which is therefore necessary for coagulation. The causes of thrombosis are:

1. **Retarded Blood flow.**

2. **Modification of the Vascular Walls**; which consists in abnormality, or removal of the endothelium.

The causes which produce such modifications are:

A. **Injuries**: mechanical, chemical, or physical.

B. **Foreign Bodies**: the presence in the vascular system of substances not covered by endothelium, *e.g.*, needles, parasites, and new growths which have penetrated into the veins.

C. **Such changes in the Blood**, or in the supply of blood to a part, as cause disease of the vessel-walls, by imperfect or improper nutrition.

D. **Certain Conditions of the Blood.** The tendency to coagulation of the blood is said to be in some measure increased in the later months of pregnancy and after profuse hæmorrhages. The increased tendency of the blood to coagulate is probably never more than a predisposing cause of thrombosis.

CHANGES IN THROMBI.—These are decolorization (when red), resolution, organization, calcification, softening (simple and infective), and putrefaction.

Organization is commonest in arteries, while softening is chiefly met with in the veins.

RESULTS OF THROMBOSIS.—The coats of the vessels are altered, and unless collateral circulation be established, thrombosis of an artery will lead to death of the parts supplied. Thrombosis of an important vein will cause painful swelling; if continued long, nutritive changes in the parts it drains, and mechanical hyperæmia, will follow.

A fragment of the thrombus may be washed away by the blood current, thus leading to embolism.

EMBOLISM.

Embolism is the impaction of solid substances circulating in the blood-vessels which are too small to allow them to pass. These solid substances, which vary much in their nature, are termed emboli. The most frequent causes of embolism are detached fragments of thrombi in the veins, vegetations, and morbid *débris* from the heart, portions of new growths and parasites.

An embolus which arises in the systemic veins will probably be arrested in one of the small branches of the pulmonary artery; while those arising from the pulmonary veins, or heart, will be lodged in the systemic arteries, and those from the radicles of the portal vein in the liver.

Thus the seat of embolism is either in the arteries or in the hepatic branches of the portal vein.

The arrest of the embolus, and the consequent obstruction, are followed by the formation of secondary thrombi behind and in front of it. The secondary thrombi extend as far as the entrance of the first large collateral vessels.

Emboli may in rare cases be absorbed. When derived from thrombi they may organize or soften.

RESULTS OF EMBOLISM.—An embolus cuts off the supply of blood from the area to which the vessel is distributed, and deprives the part of its function, for the time, at any rate.

When the embolus is small, the collateral circulation is soon established, and the part may soon regain its normal condition. In other cases collateral congestion occurs, and a backward current takes place in the veins, leading to hæmorrhage.

The thrombosed tissue, infiltrated with extravasated blood, is called an hæmorrhagic infarct.

If the infarct be infective, rapid softening and disintegration takes place and an embolic or metastatic abscess is formed.

If the infarct be non-infective and small, absorption or organization takes place. If the infarct be non-infective and large, it often softens and then becomes encapsuled, and finally dries up, leaving a fibroid cicatrix.

CAPILLARY EMBOLI.—These consist of fat, masses of organisms, white blood-cells in small masses, pigment-granules, or air.

In fractures, contusions of subcutaneous tissue, acute osteo-myelitis, and other marked conditions in which fat-cells are broken up and the fat set free, the particles are absorbed and carried away by the lymphatics and veins.

These emboli reach the right side of the heart, whence they are carried to the pulmonary arterioles and capillaries. These little plugs may be gradually swept on to the left side of the heart, and are thence distributed by the circulation to other organs, where they may collect in large numbers.

HÆMORRHAGE.

Hæmorrhage signifies an escape of blood from the general current of the circulation.

It may arise from rupture of vessels due to injury or to disease of the walls, or to overfulness or increased tension, as in congestion.

Hæmorrhage may also be due to alterations in the quality of the blood, as in purpura hæmorrhagica.

The term epistaxis is applied to bleeding from the nose; melæna, to bleeding from the bowels; hæmatemesis, to bleeding from the stomach; hæmaturia, to bleeding from the urinary passages; menorrhagia, to bleeding from the uterus.

DROPSY.

Dropsy is due to accumulation of serous fluid in the serous cavities, and in the interstices of the tissues of the body. More or less generally diffused dropsy of the integument is called anasarca. When localized, dropsy is called œdema. Ascites denotes dropsy of the peritoneal cavity; hydrothorax, of the pleural cavity; hydro-pericardium, of the pericardial cavity; hydrocephalus, of the ventricles of the cerebrum. Dropsical effusion is a colourless or straw-coloured, alkaline or neutral, clear or turbid watery fluid, having a specific gravity of 1010 to 1015. It holds albumen, salts, and extractives in solution. One of the chief pathological causes of dropsy is increased blood-pressure, which accompanies the several forms of congestion, especially that due to mechanical interference with the return of blood by the veins.

The pressure of the blood may also be increased independently of congestion, by obstruction to its flow through the capillaries, traceable to alteration of the relationship which exists between the blood in the capillaries and tissues around. Such a condition often accompanies chronic renal disease.

Dropsy may be local or general.

Local dropsy is frequently due to mechanical obstruction of the veins, as in ascites from cirrhosis of the liver. It also occurs as the result of inflammation, and more rarely of lymphatic obstructions.

General dropsy is active or passive.

Active general dropsy is abrupt in its onset, and may result from a chill or other causes. It is widely distributed, and is frequently associated with febrile symptoms.

Passive general dropsy may be due to heart or renal disease, or anæmia.

* HYPERTROPHY.

By hypertrophy we mean a quantitative overgrowth of an organ or tissue. The increase is either due to an increase in size of the individual-tissue elements, or to an increase of their number. In the former case the hypertrophy is termed simple; in the latter it is termed numerical hypertrophy.

Hypertrophy is accompanied by increase in size and weight, and sometimes also by change of shape of the organ. Hypertrophy is regarded as the anatomical expression of increased function. In muscle, for example, where it is most commonly met with, the increase of work performed is followed by increase in size of those upon which the strain is thrown.

Since it helps to maintain the balance between the work to be done and the agent performing it, this hypertrophy is termed **'compensatory.'**

ATROPHY.

Atrophy is a diminution of the substance of an organ or tissue; it is thus the reverse of hypertrophy.

Atrophy is either simple or numerical, according as it is characterized by diminution of the actual size of the tissue elements, or by a diminution of their number.

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* *Vide* also the concluding part of 'History and General Account of the Horse.'

These two varieties are generally combined.

Atrophy is accompanied by impaired function, which is frequently still further impaired by its association with degeneration of the tissue.

Atrophy is local or general.

Local atrophy may be due to—

1. Imperfect blood supply.
2. Impaired nutritive activity.
3. Excessive functional activity, leading to exhaustion.
4. Inflammation.
5. Nervous disturbance.

General atrophy is usually simple, affecting firstly the adipose tissue, then the muscles and viscera, and lastly the tissues of the nervous system.

It may be due to—

1. Deficient supply of nutriment.
2. Excessive waste; as in exhausting diseases.
3. Impairment of nutritive activity.

DEGENERATIONS.

Degeneration, unlike atrophy, is characterized by qualitative rather than by quantitative changes in the tissues and organs.

Two kinds of degeneration are distinguished.

In the one the albuminoid constituents are directly metamorphosed into some new material of lower type; whereas in the other the new material is deposited in the tissues from the blood.

The first kind is termed **Metamorphosis**; the second is termed **Infiltration**.

In both there is impaired function of the parts involved; but this is much more marked in the metamorphoses.

THE METAMORPHOSES.—There are three varieties; viz., fatty, mucoid, and colloid degeneration.

Fatty Degeneration.—This variety of degeneration is characterized by the direct conversion of the albuminoid substance, of cells or fibres, into fat. The cells or fibres enlarge at first and then break up, and the fat is thus distributed in the tissues. Caseation is a modified form of fatty degeneration.

The common causes of fatty degeneration are senile decay, deficient blood-supply, diminished vitality, congestion and inflammation.

Mucoid Degeneration.—In this form the albuminous intercellular substance, and far more rarely the cells, become liquefied and converted into a substance called mucin. Mucin is precipitated by acetic acid, and contains no sulphur, thus differing from albumen.

Colloid Degeneration.—In this form the albuminous contents of the cells (and not the intercellular matter) are converted into a jelly-like material called colloid, which differs from mucin in containing sulphur, and in not being precipitated by acetic acid.

THE INFILTRATIONS.—There are four varieties of infiltration; viz., fatty, lardaceous, calcareous, and pigmentary infiltration.

Fatty Infiltration.—In this form fat is deposited within the cells as distinct globules, which increase in size and tend to coalesce.

The protoplasmic cell-contents are at first merely pushed aside, but they subsequently atrophy. As an example of fatty infiltration may be mentioned the conversion of connective into adipose tissue. It is due to the presence of fat in blood, in greater quantity than can be consumed by the economy.

This in turn may be due on the one hand to excess of food, combined with insufficient exercise and fresh air; or on the other, to increased absorption of fat from rapid wasting of fatty tissues elsewhere.

Albuminoid, or Lardaceous, or Amyloid Degeneration.—In this form the material which infiltrates the tissues and elements is a peculiar homogeneous, translucent substance called lardacein. It impairs the vitality and functions of the tissues, and alters their appearance.

Lardacein is essentially a modification of albumen, with a deficiency of potash and phosphoric acid, but with an excess of soda and hydrochloric acid. When treated with a weak solution of iodine, lardacein exhibits a characteristic brown mahogany colour; but some other forms of altered albumen also exhibit a similar colour when similarly tested.

Methylaniline violet stains lardaceous substance violet red, the healthy tissue being coloured indigo blue.

Lardaceous degeneration is almost always of secondary origin, occurring as a sequel of some other disease; for example, prolonged suppuration, or marasmus. A case in which it followed strangles is recorded by Williams. Lardaceous degeneration first appears in the muscular coats of the small arteries, infiltrating the muscle fibre-cells and adjacent coats of the interior, and eventually affecting the other coats. Thence it invades the cells and intercellular substance of the surrounding parts. The affected tissue elements at first enlarge, become smooth and rounded, lose their nuclei, and tend to merge imperceptibly with adjacent cells similarly infiltrated.

A mass of homogeneous glistening material is thus formed, which is scantily supplied with blood, partly owing to the pressure exerted on the vessels by the swollen tissue, and partly to the narrowing of the channels of the small arteries by infiltration of their walls.

Lardaceous degeneration is especially liable to affect the liver, spleen, kidneys, intestines, and lymphatic glands.

Organs in which lardaceous degeneration is at all advanced are usually considerably increased in size, and their absolute weight and specific gravity are also increased. Their surface is smooth, and their capsule tense. Their consistence is firm and elastic. On section they present a peculiar homogeneous glistening transparent appearance, somewhat resembling wax or glue. Owing to diminution of the calibre of the blood-vessels, and to the pressure exerted by the new material, they contain but little blood, and hence are always pale on section.

Calcareous Infiltration consists in the deposition of calcareous particles, generally between, but partly also within, the elements of the tissues. The particles are composed of salts of calcium and magnesium. This form of infiltration occurs either as the result of an excess of earthy salts in the blood, as in osteomalacia or extensive caries, or as the result of impaired nutrition of tissues, owing to which earthy matter normally held in the blood in solution is deposited in them. Of the latter arterial calcification will serve as an example.

Pigmentary Infiltration.—Here pigmentary particles are deposited in the tissue-elements, just as fat or calcareous particles are deposited in other degenerations. This form of deposit has been noticed in the lungs of horses.

FEVER.

Fever is an abnormal condition of the system, characterized by undue elevation of temperature. The mean temperature of the horse, taken in the mouth and rectum, is estimated at 99° to 102° F. The average temperature of a large number of records of blood-horses, under similar conditions, taken by us in the morning, was 100·5° F.

The external parts of the body in the healthy condition are generally speaking lower in proportion to their distance from the centre of the circulation, and are liable to much variation, according to the state of the atmosphere.

The temperature of the body represents the balance between the production and loss of heat, both of which factors are under the control of the nervous system, and are brought into constant relation with each other by circulation of the blood. In fever this equilibrium is disturbed, and the temperature rises.

If the temperature exceeds 106° F. it is called hyperpyrectic; if it exceeds 104° it is high, and if below 103° it is slightly febrile.

An elevation of temperature may result from diminution of heat, loss, or from an increased production of heat, or from both combined.

Fever, however, is in all probability mainly due to increased production of heat, as is evidenced by the rapid emaciation and the increased elimination of products of oxidation of tissues, viz., urea, uric acid, carbonic acid, etc.

In fever, other conditions also are associated with elevation of temperature:

The **skin** is generally hot, and dry. In some cases it is bathed in perspiration.

Restlessness and delirium, are common **nervous** symptoms.

The febrile condition is frequently ushered in by a **chill** or rigor, due to the excessive and spasmodic contraction of the cutaneous arteries. The skin is therefore either generally, or in certain parts relatively, or actually cold.

The **pulse and respiration** are quickened in proportion to the rise of temperature, and the character of the pulse is modified. In the normal condition the pulse varies in number from 36–40, and the respirations are about 8 per minute.

Digestive disturbance is indicated by the dry mouth, coated tongue, thirst, anorexia, and constipation.

The Urine is scanty, more highly coloured, of higher specific gravity, and its solid constituents are both relatively and absolutely increased. In some instances, however—in acute pneumonia, for example—the chlorides are said to be diminished and sometimes absent.

General Emaciation takes place in proportion to the intensity and duration of the fever.

Varieties of Fever are based upon (1) the course and character:

A fever is said to be **continuous** when it persists for some time, and with diurnal variations not exceeding the normal limits. It is **remittent** when the diurnal variations are exaggerated, but the minimum does not reach the normal. It is **intermittent** when the diurnal variation is exaggerated and the minimum does reach the normal. It is **relapsing** when the fever is paroxysmal, each paroxysm being separated by intervals of one or more days, during which the temperature is normal.

Varieties of Fever are also based upon the (2) severity and character of the febrile symptoms as a whole:

Fever is called **simple** when it occurs in a mild or trifling form. It is called **inflammatory** when it is associated with acute local inflammation; **specific** when it depends upon the introduction of a specific poison in the blood (*vide* 'Inflammation'); **Malignant** when it is very severe and of an exceptionally fatal type.

Asthenic or **Adynamic** Fever is characterized by symptoms of great weakness and prostration, by comparatively slight rise of temperature, and by the skin being covered with cold clammy sweat.

The **Typhoid State** denotes a low febrile condition, in which the mouth and tongue become dry and the breath becomes fetid. There is great frequency, feebleness, and sometimes irregularity of pulse; liability to passive congestion of dependent parts; low delirium, and coma.

It is supposed to be due to defective elimination and accumulation in the blood of the waste products of nitrogenous tissues.

Hectic Fever is of an intermittent or remittent type. It occurs in connection with persistent purulent discharges, comes on insidiously, and is of long duration. It is associated with marked progressive emaciation.

Termination and Stages of Fever.—The stages of fever are termed the 'initial stage,' the 'fastigial stage,' or 'acme,' and stage of 'defervescence,' or 'decline.'

Fever may terminate in death or recovery. In the event of a favourable issue, the temperature falls suddenly by *crisis*, or gradually by *lysis*. It may fall by a combination of these two methods, as, for example, in febricula, when it sometimes first falls several degrees by *crisis*, and then gradually reaches the normal by *lysis*.

COLLAPSE AND SYNCOPE.

Collapse and syncope are characterized by functional depression, and may result from a variety of causes. They may be due to some specific poison in the system; to high fever; to suppression of certain secretions; to the action of extraneous poisons, as, for example, antimony and arsenic; to excessive pain; to rupture or perforation of internal organs; to violent injuries, and to hæmorrhage, and other causes.

In Collapse the temperature usually falls; the skin is cold, and the respirations are slow and shallow. The pulse is small and feeble, sometimes rapid, sometimes very slow. There is extreme debility. The animal may be sensible, or there may be partial or complete insensibility.

Syncope differs from collapse mainly in the suddenness of the symptoms and in their shorter duration.

DEATH.

Death may begin at the heart, lungs, or brain. When the heart's action suddenly and completely ceases, death is said to occur from syncope. When its action more gradually ceases, being accompanied by a gradual failure in the general vitality, death is said to occur from asthenia.

When death is due to interference with respiration, it is said to take place from asphyxia.

Death from coma begins at the brain, and is characterized by stupor and insensibility.

Finally, death is said to occur from necræmia when it is due to decomposition of the blood. In this case the heart ceases because the blood is no longer able to afford the necessary stimulus. As examples of this mode of death may be mentioned that occurring in purpura hæmorrhagica, scarlatina, and anthrax, and several other diseases.

CHAPTER III.

THE VEGETABLE PARASITES.

For many years scientific men have been endeavouring to discover the nature of the so-called contagion of the acute specific fevers. Now, each one of these fevers runs a more or less definite course, and presents special characteristics of its own by which it is recognised. The poison of each multiplies in a most marvellous degree, and one diseased animal may spread the fever among countless numbers by the agencies of contagion and infection.

Even so long ago as the Great Plague of London, the belief was expressed that the pestilence was probably due to some living organism, which entered the blood of man and multiplied therein, and that the virus was capable of passing from him, through the medium of the air or by actual contact, to others. But in those days men had not the means at hand necessary for the discovery of such living parasites.

That the poison could not be gaseous or liquid was soon obvious, and hence it was regarded as a solid in a state of fine division, and has been proved to be insoluble in fluids. These facts, as well as its remarkable power of multiplication, seemed to indicate that the contagion was some living organism; hence the origin of the germ theory of disease.

In 1838 Bassi and Audouin discovered the fungous nature of the muscardine disease of silkworms; and in 1840 Henle expressed a belief that living organisms, probably vegetable in nature, were the causes of the acute specific fevers.

Long before Schwann and Cagniard de Latour had discovered that yeast consisted of cells, probably vegetable in nature, which multiplied by gemmation, a close parallel was noticed between the infective diseases and the processes of fermentation.

The germ theory started by Astier, Schwann, and Cagniard de Latour, and perfected by Pasteur, is accepted by most scientists of the present day, and all the processes generally known as fermentation and putrefaction are looked upon as due to the action of vegetable organisms.

Now various micro-organisms have been demonstrated in the blood and tissues of animals suffering from various infective disorders, of which group the acute specific fevers form a division.

These organisms are of a vegetable nature, and as they possess neither root, stem, nor leaves, are referred to the Thallophyta. They have no chlorophyll, or green colouring matter, and they thus form a group of the class of Fungi.

There are three kinds of pathological fungi:

(1) **The Bacteria, or Schizomycetes,** *e.g.*, **Bacillus Anthracis.**

(2) **The Yeasts, or Blastomycetes,** *e.g.*, **Oidium Albicans.**

(3) **The Moulds, or Hyphomycetes,** *e.g.*, **Tinea Tonsurans.**

The Bacteria, besides causing putrefaction and several of the fermentations, include *almost all* the organisms which are believed to cause the infective diseases.

THE BACTERIA OR SCHIZOMYCETES are unicellular, strongly refractile, very minute organisms. They vary in shape, and appear to be structureless, though they may possess a cell-membrane allied to cellulose. They may be round, oval, rod-shaped; straight, wavy, or in the form of a corkscrew. They are never branched, and they multiply by transverse division, which in the rod-shaped forms occurs at right angles to the long axis only, but in the round forms may take place in two directions at right angles to each other. In some of the Bacilli, spore formation has been observed to alternate with multiplication by the above process of fission. This spore formation is sometimes preceded by the growth of the rods into long filaments. The new cells thus formed by fission may separate or may remain united to each other, end to end, forming chains, or lying side by side in more or less spherical colonies, they are frequently bound together by a viscid intercellular matter—zooglœa—formed of mycoprotein or swollen cell-membrane.

Bacteria multiply at an enormous rate, and Cohn estimates that a single organism may give rise to over 16,000,000 in twenty-four hours.

Single round cells have only what is termed the 'Brownian' movement; but chains and colonies do seem capable of locomotion (Ogsten). The red forms often have a mobile and a motionless stage; but some, *e.g.*, the Bacillus Anthracis, never move.

CONDITIONS OF LIFE: Food.—Each fungus must be supplied with the materials from which it can extract the elements necessary for growth. These elements, which will vary with each kind of organism, are carbon, hydrogen, nitrogen, sulphur, calcium, potassium, and magnesium. The first four are provided by carbo-hydrates (starchy or saccharine compounds) and albuminoids; the others by inorganic salts. Some Bacteria can assimilate nitrogen and carbon from much less complex bodies than albumen and carbo-hydrates, as is shown by the growth of putrefactive organisms in Cohn's fluid.

Very small variations in the composition of the food material may favour the development of one form rather than another.

As an example of this, it is noteworthy that Koch was unable to inoculate a field-mouse with organisms which always produced fatal septicæmia in a house-mouse. A similar difference may exist between two animals exposed to the action of a specific virus, when one of them is infected while the other escapes. Thus a very slight change in the system, or in part of it, may enable organisms to grow in it, though previously unable to do so.

Pasteur has divided Bacteria into ærobious and anærobious, according as they require for life free oxygen or not. The Bacillus Anthracis dies in the absence of free oxygen. Bacterium Termo and the yeast-plant can live with or without it. For Bacillus Septicæmiæ of rabbits, air is not only unnecessary but even fatal (Pasteur).

Temperature.—Each organism flourishes best at a special temperature. In some, as in Bacillus Tuberculosis, the range within which growth can take place is very limited; in others, the range is much greater.

The reproduction of Bacteria ceases at 5° C., and that of many at a much higher temperature, but death does not of necessity ensue.

Some are said to resist the greatest degrees of cold, and the spores of Bacillus Anthracis have been exposed to – 140° C. without manifest injury.

Dry spores of Bacillus Anthracis are able to resist exposure to a temperature of 140° C. for over two hours.

Boiling, and even a much lower temperature than 100° C., will kill many forms. Boiling for one or two hours will destroy all non-spore-bearing organisms, but solutions containing spores will not be sterilized unless the exposure to this heat is continued for many hours.

Rest.—Some fungi flourish better in a still medium than in one constantly agitated. Bacillus Anthracis divides actively in the circulating blood, whereas other forms seem to settle before so doing.

Clinically, two great divisions of organisms are recognised: (1) The pathogenic, which can invade living tissue, and by their growth there almost always cause disease; (2) The non-pathogenic, which can only grow in dead tissue. Bacterium Termo, the cause of putrefaction, is the most important of these.

Infective diseases are divided, according to certain characteristics of the virus, into:

1. **Contagious.**—These are communicable from individual to individual, and are frequently epidemic. The virus runs its whole course of development in the body.

2. **Miasmatic.**—These are endemic diseases, of which malarial fever is an example. The poison which causes these diseases is developed outside the body.

3. **Contagio-Miasmatic.**—In these the poison has to undergo some change external to the body, and the diseases seem to be always derived indirectly from a previous case of the malady. As an example, cholera may be given.

4. **Septic.**—The poisons of these may be derived from many putrid infusions. When once thus started, the disease can be transmitted directly from individual to individual.

The Bacillus Anthracis is the best known of all the endo-parasitic fungi. As this germ is the cause of splenic fever of cattle, anthrax of the horse, and malignant pustule of man, it will be well to give a short outline of its distinguishing features and conditions of life, as well as of Pasteur's method of inoculating animals by the attenuated organism as a preventive against future invasion. In the blood from the enlarged spleen of animals dead of splenic fever are found enormous numbers of rods, 5 to 20 μ long by about 1 μ broad, straight and motionless.

In a suitable culture-material, with a good supply of oxygen and a temperature between 15° and 42° C., the rods develop into very long filaments. In these filaments, round, highly refractile spores form at short and regular intervals. The filaments then break up, and the spores escape and may grow into bacilli. In living animals the rods multiply solely by division, and long filaments and spores are never found.

The rods are found in enormous quantities, especially in the spleen, lungs, liver, kidneys, mucous membrane of the intestines, and in various other parts.

Bacillus Anthracis is *always* present in splenic fever in enormous numbers. The bacilli may be separated and washed with distilled water, alcohol, ether, and dried ; yet they still cause anthrax fever when inoculated into animals. Pure cultivations through fifty generations may be made with the same result. This germ always gives rise to anthrax fever, and never to any other. Therefore, in conclusion, *we recognise in this germ the direct cause of this malady.*

Now, M. Pasteur asserts that he has succeeded in modifying the micro-organism of anthrax by artificial cultivation, and that by inoculating animals with the attenuated virus he is able to cause a mild form of the disease, conferring a certain immunity against future attacks.

Pasteur's Method of Preparing Vaccine, or Attenuated Virus of Anthrax.—A drop of blood, on a glass rod, is taken from an animal in the last stage of anthrax. It is now placed in a suitable clear pabulum, such as fowl broth, previously rendered sterile by subjecting to a temperature of 115° C. The vessel containing the fluid is kept in pure air at a temperature of 42° to 43° C. The fluid gradually becomes cloudy, but no spores are developed.

Now, one drop of the fluid thus prepared, and in which the first degree of attenuation is produced, is put into another vessel containing fowl broth and placed under the same conditions as the first. This process is repeated until the requisite degree of attenuation is reached. The greater the intervals which elapse between each cultivation, and the greater the number of cultivations, the less virulent will the culture become.

The 'vaccine' may be injected into the subcutaneous tissue. Great care is required in obtaining the requisite degree of attenuation.

Large numbers of sheep and other animals have been thus inoculated by Pasteur, and the results of his labours attest the practical value of his investigations.

Quite recently M. Pasteur has notified that he has been able to confer immunity from hydrophobia by inoculating with the attenuated virus of this disease.

The Blastomycetes or Yeasts.—These are roundish or oval cells which sometimes form chains by joining end to end.

The yeasts multiply by gemmation, or when food is not abundant by the formation of spores in the interior of the cells. They never invade living tissues, and are of far less importance in the causation of disease than the Schizomycetes or Bacteria and the Hyphomycetes or Moulds. As an example of the group of yeasts may be mentioned the Oidium Albicans.

The Hyphomycetes or Moulds.—These consist of filaments called hyphæ, formed by a single row of cells placed end to end, growing by means of an apical cell which elongates and divides transversely.

The Thallus usually consists of numerous hyphæ, though it may be formed of one only. Several skin diseases are to be attributed to invasion by these vegetable parasites.

Tinea Tonsurans is due to the growth of Trichophyton Tonsurans, and Tinea Favus to Achorion Schönleinii. Bursatee is similarly due to the growth of one of these moulds, as also is Actinomycosis and the 'Madura foot' of India. The mould causing Bursatee has been described by Mr. F. Smith, of the 12th Royal Lancers, in the *Veterinary Journal* for July, 1884.*

The Actinomyces, the vegetable fungus of Actinomycosis, is of recent discovery, though even so long ago as the year 1872 the late Mr. D. Gresswell expressed his belief that many of the indurations of a certain character met with in the tongues of oxen, and variously described as schirrhous and tubercular, were due to the invasion by a 'vegetable mould.' With this view, accordingly, he treated them with the injection of sulphurous acid, and sometimes of carbolic acid or tincture of iodine.

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* Mr. Smith writes: 'The actual exciting cause of Bursatee is a mould fungus. I have found it in every fresh specimen of the sore that I have examined. . . . The filaments or hyphæ are branched not septate, $\frac{1}{20000}$ of an inch wide and so long that they cannot be followed as they pass in and out of the tissue. . . . I have lately produced typical Bursatee ulcers by inoculation with portions of the tumour, and am at present working this out, and endeavouring to produce the sore from the cultivated moulds.'

CHAPTER IV.

GENERAL DISEASES.

FEBRICULA, OR SIMPLE FEVER.

Definition.—Febricula is a simple fever characterized by rigors, elevation of temperature, quick pulse and respirations. It is a benign affection, and usually terminates in restoration to health, and is unaccompanied by serious complications.

Etiology.—Among the causes of simple fever are: exposure to cold and wet, variations in temperature, fatigue, and irregular dieting.

Symptoms.—The first stage, *i.e.* the *attack*, is usually ushered in by a rigor or shivering fit, with rise of the internal temperature from 101° to 105° or more. The pulse is usually raised to 60 or 70, the respirations are somewhat accelerated, and there is loss of appetite. In the second stage, which follows in a few hours, the fever reaches its *acme*. The volume of the pulse is increased and the surface temperature rises, the bowels are costive, and the internal temperature remains elevated for several days. In the third stage, or *stage of decline*, or *defervescence*, as it is termed, the temperature usually falls several degrees by *crisis*, and then gradually falls to the normal by *lysis*.

Treatment.—Place the animal in a loose, well-ventilated box. In the early stage the surface temperature should be kept up by friction and by moderate clothing. Medicinally, liquor ammoniæ acetatis, spiritus etheris nitrosi, and potassium nitrate or bicarbonate may be given three times daily. The diet should consist of bran-mashes, linseed gruel, grass, carrots, etc. A horse after a severe day's work may come in with elevated temperature and marked muscular tremors. A dose of solution of acetate of ammonium of about one fluid ounce will often set right horses thus affected.

STRANGLES.

Synonyms.—Febris pyogenica; morbus glandulosus; gourme (French); colt-ill; druse, kropf (German).

Definition.—A specific febrile disorder, in which there are purulent accumulations in the connective-tissue of the submaxillary region and in the neighbouring glands, accompanied by inflammation of the upper air-passages.

Prognosis.—The benign form seldom extends beyond a period of fourteen days, and nearly always terminates favourably. Malignant strangles may be of one or two months' duration, and the animal may die of various complications, viz., pyæmia, asphyxia, or peritonitis.

Contagium.—Strangles is, no doubt, both contagious and infectious, and may assume an epidemic form.

General Account.—Most of our readers who have had much to do with young horses have doubtless some little knowledge of strangles or colt-ill; yet, although this malady has been well recognised even from early times, there are still many diverse opinions respecting its nature.

The disease occurs in most parts of the earth. It is said to be somewhat rarely met with in Southern Europe, although in Germany and the northern and western countries it is commonly met with. In Africa and in

Arabia, and, indeed, in all countries in which the Eastern horse, with its highly nervous temperament, is the only representative of the race, strangles is said to be absent.

Although the disease is more especially liable to attack horses from two to five or six years of age, and most particularly young horses between the age of two and three, it may infect animals of any age or breed. We must remember that when foals have been once affected with this disease, they may again be attacked, as one attack does not by any means confer immunity, although it seems that animals which have once been affected are less liable to be affected a second time. When strangles affects older animals, it does not differ very much from an ordinary cold, which may or may not be accompanied by soreness of the throat.

Some authors look upon strangles as an ordinary catarrh or cold, while others regard the disease as allied to glanders and other malignant diseases. We are of opinion that the malady is to be looked upon as an eruptive fever, *i.e.*, a fever which is accompanied by the appearance of an eruption, which in the case of this complaint consists of, or is evidenced by, one or more abscesses formed between the branches of the lower jaw. The late Mr. D. Gresswell, F.R.C.V.S., was as well satisfied of the contagious character of strangles as of influenza.

Regarding the causes of strangles we cannot speak definitely; yet it is certain that this disease, in like manner with influenza, seems to be more especially liable to affect animals which are subjected to unhealthy conditions, such, for instance, as bad drainage, contamination of the water-supply with sewage matter, defective ventilation, overcrowding, and other agencies of a like nature. Indeed, we may say that this complaint seems to be more likely to attack horses debilitated from any cause than stronger and more vigorous animals, and when it does attack weaker individuals it is more prone to assume a severe type. As an occasional predisposing cause, we may also mention the replacement of the milk-teeth by the permanent teeth which succeed them. Again, any severe injury leading to inflammation, an insufficient quantity of food, changes in the place of abode, and changes in the weather, are also doubtless of great influence in causing the appearance of strangles in horses. It has been noticed that, in like manner with influenza, this disease is more markedly prevalent in spring and autumn than in summer or winter.

Dr. Fleming says that, of horses affected with strangles and sent to the Alfort Veterinary School, 88 per cent. were found to be newly purchased and imported from breeding districts, and also that Reynal has seen six hundred remounts, hurriedly purchased in foreign countries and sent to the army corps, suffer without exception from strangles. In remount depots and regiments receiving new purchases, the disease not unfrequently breaks out within a month of the arrival of the new animals.

The name 'strangles' arose from the great difficulty experienced in respiration, the breathing being accompanied by the uttering of a trumpet-like sound, which was more marked during the inspiratory acts, this sound resembling in some measure that produced by strangulation.

Before speaking of the symptoms of strangles, we ought to point out that there are two varieties of this malady, the one being called mild or benign, and the other kind being denominated malignant strangles. The disease seems to take on the malignant form when the animals have been subjected to non-hygienic conditions, and other debilitating influences.

In the case of animals suffering from benign strangles, the attendant in the first place usually notices slight cough and difficulty of swallowing, owing to soreness of the throat.

The disease is ushered in with simple continued fever. The animal is dull and dejected and disinclined to eat, and shows signs of mild catarrh. The number of the beats of the pulse per minute is increased, and the temperature also is elevated. The respirations, too, are accelerated. The animal is swollen about the throat, and this swelling may occupy the space between the branches of the lower jaw, or it may be formed on one side of the throat only, or may, on the other hand, be more generally diffused among the tissues. The swelling gradually enlarges, and eventually pus may be detected by its fluctuation, and one or more abscesses may be formed. Œdema of the glottis and general infiltration of the submucous tissue of the larynx may supervene. When the throat becomes, as it sometimes does, more severely affected, the glands and tissues in the region of the larynx are more seriously involved, and the structures which form the upper part of the windpipe become so much swollen that breathing is performed with difficulty, and hence while the horse breathes, the trumpet-sound is produced as a result of the passage of the air through the swollen, and therefore obstructed, air-channel. This sound is more marked while the animal is inspiring air, than while it is breathing it out, and the tendency to make it usually passes off under treatment. Sometimes this inflammatory condition of the throat is more severe, and also more persistent, and is a source of danger to life by means of suffocation or strangulation. The benign form of strangles seldom extends beyond a period of fourteen days, and it nearly always ends favourably.

In the case of animals affected with malignant strangles, the fever is more severe, and the glands which secrete the saliva become affected, and may suppurate and form abscesses. Sometimes the parotid, the tracheal, the inguinal, and the mesenteric glands become affected, and form abscesses.

In the case of several animals affected with this disease which were met with in practice during the year 1887, the throat was swollen all down the neck almost as far as to the shoulder. Several thoroughbred colts were affected in this manner. By means of continuous poulticing and other careful treatment, the animals were cured, and immature abscesses were thereby formed. It was found to be necessary to lance these abscesses. They were of such a severe and acute kind as to threaten the lives of the animals. An enormous quantity of sanguineous purulent material resembling raspberry-jam in appearance was discharged when the abscesses were opened. The similarity may seem highly disagreeable, but the look is very much like it.

The fever may last for a very long time. Malignant strangles may last for one or two months, and the animal may die as a result of various complications—namely, from poisoning of the blood by the formation of matter, or from inflammation of the lining membrane of the belly.

When abscesses are formed in the internal organs, the symptoms vary in accordance with the particular organs which are involved, and the fever will be subject to intermissions and irregular paroxysms. Exhaustion, acceleration of respiration, prostration, local dropsy, marked wasting of tissue, and occasionally an irregularity of the action of the heart, may follow. Difficulty in breathing and cough usually occur if the abscess be in connection with the mediastinum, and death may ensue in consequence of pus finding its way into the bronchi, or owing to the neighbouring organs becoming involved in the inflammation. If the mesenteric glands be affected, peritonitis may ensue, and prove fatal.

Sequelæ of Strangles.—Whistling is sometimes left as a sequel of strangles. As for ourselves, we have never seen a case of roaring follow either strangles or influenza. This may possibly point to a marked distinction existing between whistling and roaring. We know of at least forty cases of whistlers which have become whistlers as a result of acute influenza or other similar and allied fevers. Roarers, as a rule, seem to become progressively worse, whereas whistlers do not generally become markedly worse. When a horse first begins to be a roarer, it may perhaps appear to be a whistler; but an experienced observer would be able to detect the difference. Whistling does not materially interfere with the usefulness of a horse, but roaring certainly does. For hunting purposes a roarer is quite worthless, since such a horse is apt to be a public nuisance to the other huntsmen and huntswomen in the field by reason of its loud squealing and other noises. Hence it seems that whistling can by no means be considered as merely a mild form of roaring.

The most important sequelæ of strangles are pyæmia and septicæmia, the former of which is accompanied by the formation of abscesses in various parts, more especially in the limbs. The onset of pyæmia is associated with sudden increase in the febrile manifestations, by regularly recurring paroxysms, irregular action of the heart, and accelerated respiration. Shortly afterwards multiple abscesses form in various parts, especially in the limbs. The structures in connection with the joints may be invaded by these small abscesses. When the lung or heart or liver is invaded, there is but little hope of recovery, and pneumonic or cardiac or enteric symptoms are developed.

Bacteria have been demonstrated in pyæmic lesions, and it is probable that when pyæmia comes on in cases of strangles, it is traceable to the fact that the animal has been subjected to bad hygienic conditions during the occurrence of the primary malady.

In regard to general management and treatment, we may say that we ought to endeavour, in the first place, to isolate the infected animals as quickly as possible, and to keep a careful watch over the others. According to Charlier, bovine animals may become infected with strangles, and this observer says that he has known of this disease being transmitted from horses to beasts which have been lodged in a badly ventilated, filthy stable wherein the diseased horses had been kept. Dr. Fleming says that he remembers some years ago a particular stable in the cavalry barracks at Edinburgh which was called 'the strangles stable.' At that time it seems to have been erroneously believed that it was necessary that all horses should become at some time or other affected with the disease. In consequence of this opinion, remounts were always lodged therein, in order that they might be attacked by the malady. The desired result was nearly always attained. In these days no one can hold such views as that animals must be seized by certain diseases.

We must remember that, when an animal takes the infection of strangles, symptoms of illness are not immediately shown. On the other hand, the disease at first remains latent—or, in other words, in an incubatory condition—for a period of one week to three weeks or so.

Having, then, isolated the diseased animals, and having placed them under suitable hygienic management, we ought to proceed at once to disinfect the contaminated stables, when empty, by causing them to be filled with the fumes of burning sulphur. This is a very essential precaution, and it should never be neglected by those who wish to keep their stables in a healthy condition. The diseased animal should be placed in a moderately warm and well-ventilated, but not draughty, loose-box; in fact, the sanitary conditions should be as good as possible. In mild cases such remedies as sulphate of magnesium, sulphate of sodium, nitrate of potassium, and bicarbonate of potassium will suffice. If laryngitis and tracheitis be present, camphor, ipecacuanha, and nitrate of potassium may be given.

The diet should at first be laxative, and consist of such food as mashes, linseed-cake, gruel, roots, and grass. To animals which are affected in a mild way, a febrifuge draught may be given thrice daily. The following is a useful draught: Take of—

Solution of acetate of ammonium, four fluid ounces.
Spirit of nitrous ether, one fluid ounce.
Bicarbonate of potassium, half an ounce.
Water to half a pint or a pint.

If severe throat-symptoms should supervene, it is necessary to allow the horse to breathe the vapour of hot water to which carbolic acid has been added. This is a very valuable measure to adopt. Should symptoms of strangulation show themselves, it is sometimes necessary to make an opening into the windpipe, and to insert into it an instrument through which the horse can breathe air, the inflamed and obstructed orifice of the air-channel or glottis no longer allowing of the passage of air in sufficient amount. Counter-irritants, such as ammoniacal liniments, should be applied to the throat. It is sometimes thought preferable to apply a smart cantharides blister.

The veterinary surgeon inserts the tracheotomy-tube into an opening which he makes at about the junction of the upper and middle thirds of the trachea. This air-tube (the trachea) is composed of rings of cartilage or gristle, and in the operation two or three of these rings are cut through. The tube is then inserted into the orifice which has been made, and it is tied in its place.

When an abscess is being formed, it is advisable to apply blisters if it be tardy in coming to a point. Some persons, however, may prefer the application of poultices. Many accidents have occurred from the opening of abscesses by amateurs. In one case the duct or tube which conducts the saliva from the gland to the mouth was cut, and the consequence of this was that for a long time afterwards a pint or more of saliva daily ran from the opening made.

Sometimes little vesicles or blebs form on the skin in parts where a deep abscess is being produced. These blebs are valuable guides in helping us to locate points of inflammation.

After an abscess has been opened, it must be kept very clean, and must be dressed with a solution of carbolic acid (1 fluid part of carbolic acid in 25 parts of water) or some other suitable antiseptic. Such ointments as are called digestive are in certain cases very useful. In the case of animals affected with malignant strangles, antiseptic medicines taken internally are very valuable. Sulphite of sodium especially is of very great value. As the fever of strangles abates, tonics and stimulants are requisite to restore strength. When the animal is greatly debilitated, such medicines are required even very early in the progress of the malady. Poultices may be applied to the throat.

Blister or poultice any enlargements, and when fluctuation is detected, open with the lancet, keeping the parts as clean as possible with an antiseptic solution. A fresh hot poultice should be put on, and renewed every hour; and if this be done, great hopes may be entertained of averting the necessity for the operation of tracheotomy.

The diet should at first be laxative, consisting of mashes, roots, grass, linseed gruel, etc. When the fever defervesces, tonics and stimulants and more liberal diet may be given.

Tracheotomy should be avoided, if possible, but if there is danger of asphyxia, this operation should not be delayed.

Method of performing Tracheotomy.—Elevate the head and make a longitudinal incision, about two inches long, in the mesial line of that part of the trachea least covered over with muscular or other tissue. This spot will be found to be about the junction of the upper and middle third of the trachea. However, tracheotomy may be performed lower down than this. Two or more rings may be divided transversely, or a circular portion may be excised. In the latter case a needle armed with a ligature is passed through a ring of the trachea, and then a circular portion is removed with the knife. The tracheotomy-tube is now inserted, and is left as long as the difficulty of breathing continues. In malignant strangles, such antiseptic medicines as sodium salicylate, salicine, or sodium sulphite, are well worthy of trial.

INFLUENZA.

Synonyms.—Distemper; epidemic catarrh; the epidemic; epizoötic catarrhal fever; panzoötic catarrhal fever; febris catarrhalis; courbature, morfondure; epidemic pleurisy; pink eye; pneumo-enteric fever.

Definition.—Is a specific, contagious, and infectious, febrile disease, usually involving the upper air-passages, and subject to a variety of complications. It generally appears as an epizoötic.

Geographical Distribution and Historical Review.—The first recorded outbreak of this malady occurred at Seville, in the beginning of the fourteenth century. In the years 1688 and 1693 severe epidemics occurred throughout Europe. In these epidemics horses were first affected, and then followed similar fevers in man. The last great outbreaks in this country were in the years 1863, 1864, and 1871 and 1872. The disease is widely distributed over the Old and New Worlds, and is nearly always liable to be met with at all times of the year, but especially in the autumn and the spring.

Varieties and Complicated Forms.—(1) The usual simple catarrhal form; (2) Complicated forms are—

A. The thoracic form.
B. The abdominal form.
C. The rheumatic form.

Prognosis.—Usually favourable.

Sequelæ.—If the pericardium be affected, pericardial adhesions may result; and if the heart be affected, valve lesions may remain.

The upper air-passages may be so altered as to cause abnormal sounds, as, for example, whistling. This disease may lead to a permanent thickening of the parotid glands.

Etiology.—This disease appears in all climes and at all periods of the year, but is more prevalent in the spring and autumn. It affects alike animals of all ages, breeds, and sex. It is not proved to be influenced by geological characteristics, climatic or astronomical causes. Animals are predisposed to attack by bad sanitary conditions—*e.g.*, by overcrowded stables and defective ventilation.

General Symptoms of Influenza.—Great prostration, with catarrhal inflammation of the respiratory, and sometimes of the other, mucous membranes, accompanied by pyrexial symptoms, characterize all the varieties of influenza.

Symptoms of the Uncomplicated Catarrhal Form.—In many cases the constitutional symptoms are but slightly marked. The legs and ears are usually cold, and there is a short irritable cough and sneezing. The throat is sometimes swollen and tender to the touch. The pulse is feeble and frequent, and the thermometer indicates a variable elevation of temperature. In a few days the temperature may rise to 105° or 106°; the pulse may reach 60—80 beats per minute, and the respirations become accelerated. The other symptoms also increase in severity: the cough becomes deeper and deeper; the throat becomes sore, and there is also difficulty of swallowing.

The debility and prostration become more intense, and there is marked thirst. The nasal mucous membrane, at first dry, becomes moistened, and there is a discharge of mucus. The bowels are sluggish, the fæces become hard and coated with mucus, and the urine is scanty and high-coloured, and often contains albumen, or excess of urea and hippuric acid or of urates.

In about a week the symptoms gradually abate. The nasal discharge increases in amount, becoming thicker and purulent. The cough is moister, and the temperature falls by lysis, and convalescence is established in about fourteen days from the onset of the fever. In some outbreaks of influenza the fever assumes a decidedly remittent form. The temperature may fall in the course of eight hours as much as from 106·5° F. to 102° F., and then again rise to 105·5° F. in the course of from three to six hours.

Sometimes, however, recovery is retarded, and the pyrexial symptoms recur. This is owing to the implication of the glandular structures around the throat, and of the neighbouring connective tissue, terminating in suppuration in the sub-maxillary and parotid glands, or in the surrounding tissue.

A Special Form of Catarrhal Influenza, known by the names of 'pink eye,' 'pneumo-enteric fever,' 'epizoötic cellulitis,' was very prevalent in the year 1884. By some persons it has been regarded as a distinct disease; but it is probably only a modified form of simple influenza. In this form the conjunctiva is of a pinkish colour, and in many cases the sub-conjunctival tissue is infiltrated with hæmorrhagic exudation. The constitutional symptoms are sometimes very severe, and the temperature may rise to 105° or 106°, or even to 107°.

Sometimes severe pneumonic symptoms develop, when large portions of one or both lungs become implicated. Violent diarrhœa, colicky pains, and other enteric symptoms, may also supervene. In some cases there is total loss of power in the hind-quarters, and sometimes, though rarely, cerebral symptoms may be manifested.

When occurring in strong horses, pneumo-enteric fever is usually a mild affection; but, when attacking animals in a low condition, it is more serious. The more the internal organs, as the lungs, intestines, and heart, are involved, so much more dangerous is the malady.

The sudden death which sometimes occurs has been attributed to the formation of thrombi in the cavities of the heart, and also to actual cardiac lesions.

The following remarks on 'pneumo-enteric fever,' by Charles Gresswell, are taken from the *Veterinary Journal* for 1883, vol. xvi., pp. 233-236:

'A few observations on the epizoötic disease commonly called "pink eye," to which, however, the designation "pneumo-enteric fever" may, perhaps, more fitly be applied, will probably be considered appropriate and interesting at a time when the prevalence of the disease in Nottingham and other districts has lately been a noticeable phenomenon.

'Isolated cases of this disease have, it is true, been seen here from time to time during the last eighteen months; but it was not until December, 1882, that any serious proportions were assumed. During the middle of that month some Russian ponies, which had recently arrived in the town, were found to be affected, and one or more died. From these, as a centre, the disease spread, at first manifesting itself amongst the horses occupying the other stables of the public-house yard in which the ponies had been quartered. The propagation of the disease from this yard to places two and three miles distant, I have been able most distinctly to trace. As an instance, I may mention the case of an owner of three horses employed to lead manure from the yard, one of his horses being visibly affected four days after exposure to the infection, another on the fifth day after such exposure.

'It may be mentioned that, in the majority of cases which I have attended, direct contact with other affected horses could be proved, and that the first outward symptoms were invariably manifested on the fourth or fifth day subsequent to that on which this contact was known to have occurred. From the fact that, in many instances where the existence of the disease was discovered, the temperature was observed to be elevated to 101° or 102° on the third day, it may be inferred that the period of incubation is to be considered as extending over three or four days. On the fifth day after contact, which may be called the second day of the disease, there may be observed a temperature of 103° to 104°, a pulse varying between 60 and 70, general dulness, irregular shambling gait, injected mucous membranes and tumefaction of eyelids, more or less pronounced in character. The appetite may or may not be markedly impaired. On the third day of the disease, the symptoms are greatly exaggerated; the temperature may be as high as 105°, or even 106·5°; the pulse 70 to 80, small, and in many cases scarcely perceptible; the mucous membranes purple or red. There is a discharge from the eyes, and frequently an opacity of the cornea is perceptible. Finally, accelerated respirations and total anorexia are to be noted. Extending from the third to the sixth day of the disease, more special symptoms, indicating, in all probability, extensive exudation into special tissues and organs, may be recorded. Amongst these, serious pneumonic symptoms, implicating large portions of one or both lungs (in some cases associated with pleuritic complications); enteric symptoms, including abdominal pain; intermittent action of the heart; extreme nausea; partial, or in rare cases total, loss of power in the hind quarters; violent diarrhœa; finally, though rarely, cerebral symptoms; are most prominent: whilst death from asphyxia or collapse finally occurs. It is not, however, to be understood that the above characters are co-existent in all, or even the majority of, patients. It seems that, as a general rule, the exudation takes place in sets of organs or tissues which may be considered to exhibit a co-ordination or similarity of functions; and where recourse is had to scientific treatment in the earliest stages, it may most emphatically be asserted that the onward course of the disease may be arrested, the severe symptoms prevented, and a more or less complete cure the favourable result.

'A post-mortem examination invariably displays a characteristic congestion of the lungs, heart, or stomach. One or both lungs may be thus congested, and, as a rule, hypertrophy of the heart is visible. In all the other parts affected there is an exudation of lymph, which is frequently especially marked in the submucous tissue along the whole course of the intestinal tract, between the folds of the peritoneum, and also in the brain and spinal cord.

'Thus the name of pneumo-enteric fever has appeared to me an appropriate one, and I may be allowed to record my conviction that the disease is to be regarded as depending upon the presence in the blood of a specific virus, which produces in the first instance pyrexia, secondly, congestion of the heart, lungs, and stomach, and, finally, extensive infiltration—that is, exudation of the fluid portions of the blood into the most important organs of the body.

'Horses in low condition, or otherwise debilitated, seem to be principally and most markedly affected. The disease, when appearing in strong horses, usually assumes a very mild form; the percentage of deaths is very small, only resulting in cases aggravated either by neglect, by being worked in the first stages, by bad treatment, by imperfect sanitation, or by a previously low condition of the animal due to other causes. Patients which have been treated at an early stage, and have had the advantage of good sanitary conditions, and a previous fair state of health, will very rarely succumb. The percentage of fatal cases should in such instances be very small.

'In the most favourable cases the temperature usually falls on the fifth day to about 103°, on the sixth to about 101°, being normal on the seventh. The gradual fall of the pulse is in about the same proportion. In less favourable cases the temperature will remain at about 105° for several days, finally, however, undergoing a rapid fall, with an almost equally sudden cessation of other symptoms. Where a fatal result is to ensue, the heart's action and the function of respiration become gradually more markedly impaired, until the animal dies in asphyxia at about the seventh day. Sometimes, though rarely, death from collapse at about the fourth day has occurred.

'In conclusion, I must state my conviction to be that this disease is entirely different from influenza; that it is, in fact, a specific fever, with well-marked periods, and dependent upon the existence of a germ of a specific and contagious nature. The fixed period of incubation; the gradual rise of temperature, followed, as a rule, by a similar gradual fall; the great severity of the general febrile symptoms; the characteristic exudations and congestions, with the total absence of inflammatory action; the probable dependence upon living microzymes; its highly infectious nature, together with its other symptoms, most distinctly differentiate pneumo-enteric fever from influenza proper.'

Symptoms of the Complicated Forms—

A. Thoracic Form.—In this form the respiratory organs especially, or the cardiac organs, or both, may become affected, more commonly the former. The late Mr. Robertson classified the thoracic forms of influenza into (*a*) capillary bronchitis, (*b*) capillary bronchitis with cardiac disease, and (*c*) pleuro-pneumonia. We prefer to divide the thoracic forms as follows: (*a*) bronchial, (*b*) pleuro-pneumonic, (*c*) pleuro-pneumonic with pericardial disease. All these forms may be detected by careful auscultation, and in all the pulse is frequent and feeble, and in the case of cardiac disease of irregular rhythm.

The pneumonia of influenza is characterized by an acute, hacking, and in bad cases very painful, cough, acceleration of pulse, coldness of the extremities and of the surface of the body. The pneumonia, being of the asthenic type, may terminate in gangrene and disintegration of the lung-tissue.

The form of thoracic influenza which is most commonly met with is that which we have above called the pleuro-pneumonic form. This kind of influenza has been very markedly prevalent in Lincolnshire during the months of the spring and autumn of the year just closed (1888). When horses are first attacked with the fever, the only apparent symptom is a slight acceleration of the respirations. On examination, the pulse is found to be about sixty per minute in number, and also decidedly feeble, while the temperature rises to 103·5° F. or 104° F. In the usual course of the fever the temperature rises quickly to 106° F., to 106·5° F., or even to 107° F. The temperature of one horse, a black two-year-old stallion, was even as high as 107·3° F. In this animal the pulse was 127, while the respiratory movements were short, and of a gasping character, and numbered fifty-eight per minute.

As a result of the action of antipyrin the temperature went down to 104° F. in a little under five hours. After eight hours had elapsed, the horse died.

The other forms of thoracic influenza may be detected by means of careful auscultation.

Certain peculiar differences may be detected in regard to the onset of an acute attack of pleuro-pneumonic influenza. In the first place it is to be noted that the attack is sudden. In the second place, it is very noticeable that, from the very outset of the disease, the respiratory movements are decidedly quickened. If the pleura be more particularly implicated, a slight sighing is made when the animal breathes. Any doubt on this point may be comparatively easily determined by having recourse to the methods of auscultation.

In the third place, if the animal be very acutely attacked, it may die, even before any actual inflammation, properly so called, has had time to set in, the accelerated respiratory movements being due in this case to pure hyperæmia.

In the fourth place, the cough is of a particularly distressing character. The coughs are deep, strong, and heavy, and one follows quickly after another, and in some cases the coughing may be almost of a spasmodic character.

The carcase of one animal which had died was examined. It was that of a three-year-old chestnut filly, and it succumbed to an attack of this form of the disease which lasted for four days. The lung was found to be gangrenous in patches, whilst other parts of the body were perfectly healthy.

B. Abdominal Form.—In this form the catarrhal inflammation spreads down the œsophagus, and involves a considerable portion of the intestinal tract, frequently leading to complete occlusion of the opening of the biliary duct, and thus giving rise to the so-called bilious catarrhal fever.

The gastro-enteric irritation and the mucous effusion may be so intense as to lead to a fatal form of diarrhœa.

The abdominal form of influenza is divisible into two distinct kinds, each of which requires special treatment:

(1) In some cases we meet with an acute gastro-enteric irritation, in which form acute diarrhœa and great prostration and weakness manifest themselves.

(2) In other cases we meet with bilious complications. The mucous membrane being severely inflamed in a catarrhal manner, the opening of the bile-ducts is occluded, and hence the bile is, so to say, thrown back into the blood and reabsorbed.

This form is evidenced by yellow mucous membranes, especially inside the nose and the eye. The visible mucous membranes are yellowish in colour, the bowels are constipated, the fever is quickened, and there is great prostration; the pulse is remittent, and the temperature varies from 101° or 102° to 104°.

C. Rheumatic Form.—This form usually manifests itself towards the close of the ordinary symptoms of catarrh. It may be diagnosed by the pain in the joints, which crackle when moved, and after a time swell.

Although the joints are especially liable to be affected, the muscles and the flexor tendons below the knee and hock are also sometimes involved. The swellings, like those of rheumatic fever, are metastatic. Cardiac complication may appear in this form of influenza.

Immunity.—One attack of influenza does not secure immunity from a second or even a third.

Morbid Anatomy of Influenza.—There is inflammation of the mucous membrane of the respiratory tract, extending into the minute bronchi, and pulmonary lobules are thus often found collapsed. In the various complications we find corresponding pathological lesions. In some large towns, patches of ecchymosis have been noted in the stomach and fore part of the alimentary canal.

The blood is dark in colour, and contains micrococci.

Treatment.—The animal should be placed under good hygienic conditions, and should be kept warm with rugs. Rest is in all cases essential.

The diet should at first be laxative, and consist of mashes, linseed gruel, roots, etc.

Medicinally, nitrate of potassium may be given in the water. Also liquor ammoniæ acetatis and spirit of nitric ether may be given in the form of a draught twice or three times daily. Sulphite of sodium in two drachm doses, or sulpho-carbolate of sodium in one drachm doses, twice daily, may be given in addition. If laryngitis come on and be serious, camphor and belladonna may be administered, and hot-water vapour, medicated or not, may be inhaled. Blisters or poultices also may be applied to the throat.

When convalescence is established, vegetable tonics with ammonium carbonate, or full doses of sulphate of iron or other tonics, may be given.

If the lungs are involved, the application of hot-water blankets to the chest is called for, or a smart counter-irritant may be applied.

If the bowels are affected, doses of morphia and chloric ether should be given to alleviate the pain, and hot applications or soap liniment used externally. If the bowels are costive, oleum lini or magnesium sulphate may be administered. If the bowels continue unrelieved, give a gentle dose of calomel. In the rheumatic form, hot applications and stimulating liniments should be employed for the swellings, and doses of bicarbonate of potassium given internally. If the temperature be high, salicylate of sodium is indicated.

The treatment of horses suffering from influenza must necessarily vary very much. In very many cases of influenza the newly-discovered drugs called respectively antifebrin and antipyrin are of great value. Either of these drugs may be safely given in doses of one or two drachms every three or four hours until the temperature falls. The antiseptics, such as salicylate of sodium, are also very useful. Special symptoms must be specially attended to. The best results seem to follow the internal administration of antipyrin in one-drachm doses, repeated every three hours until the temperature falls to 101° or 100° F. After this fall of the temperature, diluted hydrochloric acid may be found very useful indeed.

GLANDERS AND FARCY.—EQUINIA.

Synonyms.—Equinia apostimatos; malleus humidus; farcina equi; affection morveus; morva farcino (Italian).

Definition.—A specific, highly contagious fever, which, though especially affecting the equine race, is readily transmissible to man, sheep, goats, felines and rodents.

The mucous membrane of the nose, frontal sinuses, and larynx and trachea, are specifically affected. There may be inflammation of the lymphatic glands, vessels, and skin, and small round buds known as 'farcy buds' may form and develop into pustules.

Geographical Distribution and Historical Review.—Glanders is described by Aristotle and Vegetius, and we read of it as far back as the time of Constantine the Great.

It is said to be absent in Australia, and rare in India, except when imported. It is mostly a disease of temperate climes, and is well known in Norway and Java. The form of the malady usually met with in this country is chronic glanders.

Contagion.—The contagium is present in many of the secretions and in the blood of the diseased animal. It is present in the greatest virulence in the discharges from the ulcers and nose.

Inoculation.—The disease is developed when infected material is given either in the water, or the food, or in the form of a bolus. The disease may be communicated by inoculating an abraded surface of the skin, or by injecting the virus into the blood-vessels.

Incubation.—The period of incubation varies. Most writers give it as three to seven days. It is, however, probable that it may sometimes greatly exceed this limit.

Varieties.—Acute and chronic glanders; acute and chronic farcy.

Etiology.—It is difficult to ascertain in what way the contagium gains access to the system. It is almost certainly due to some definite materies morbi, which will probably prove to be some form of bacterium (*vide* Chap. III.).

Horses which have been subjected to debilitating causes, as bad sanitary conditions, overwork, improper food, are especially susceptible to this malady.

Symptoms of Acute Glanders.—The febrile symptoms are very marked. Rigors may be persistent. The temperature rises rapidly to 105°, and may even reach 107° or 108°. It remains elevated for a variable number of days. The pulse is rapid, feeble, and sometimes fluttering, and its volume is diminished. The respirations are accelerated; the urine, especially when the fever is declining, is sometimes pale, increased in amount, and albuminous. The appetite is impaired, and there is marked debility and emaciation. The Schneiderian membrane varies in colour from a light to a dark brown, and the other visible mucous membranes are highly congested.

In a few days (three to six) the febrile symptoms abate, returning again after a variable period of remission, during which the characteristic local lesions are developed. The pituitary membrane, especially that of the nasal septum and of the alæ, becomes studded with small tubercular nodules arranged in groups, or more generally diffused over the surface of the mucous membrane. When, as sometimes occurs, the subjacent tissue of the latter is much infiltrated, the patches become more prominent.

The nodules vary in size from a small seed to a pea, and appear as projections on an elevated base of congested mucous membrane. They have a yellowish white centre, surrounded by a greyish zone, round which is again a reddish one.

In a few days the diffuse patches and nodules gradually soften, and ulceration commences in the central portions of the latter. Thus, as the epithelium is removed, there is produced a characteristic ulcer with irregularly excavated borders. The floor and edges of the ulcer may become studded with small nodules, and covered with prominent vascular granulations.

The ulcers gradually extend and coalesce with one another, forming larger ones, which eat their way into the underlying tissue, and even at times lead to necrosis of the nasal septum.

The above pathological changes also involve the larynx and the mucous membrane of the sinuses of the head. The discharge from the nose, which during the onset of the febrile symptoms was yellowish and somewhat viscid, becomes, as the nodules ulcerate, thick, gluey, and purulent.

As the ulcers extend, the secretion may become sanguineous, owing to erosion of the walls of the small vessels. The neighbouring lymphatics and lymphatic glands, of one or both sides (according as *one* or *both* nasal cavities is affected), become enlarged. Those of the intermaxillary space are especially liable to become involved, and though at first painful and tender, rarely suppurate, but become harder and less painful. The lymphatic vessels, and especially those from the nose and mouth to the glands in the intermaxillary space, become nodulated, and may ulcerate and discharge a purulent fluid.

The scalp, face, and the tissues round the mouth become œdematous and swollen. The affection of the lymphatics spreads to those of the extremities, and nodules form on them and gradually disintegrate. Owing to the changes above described, the breathing of the animal becomes snuffling and hoarse, and there is in many cases frequent and painful cough.

Pneumonic or Pulmonary Glanders.—This is a form or complication in which the lung becomes variously complicated, from the formation of glanderous tubercles in its substance.

It can be diagnosed by careful auscultation and percussion, and by the characteristic soft dry cough. There is extreme debility and anorexia. Dyspnœa is marked. Œdema of the extremities and cutaneous infiltration ensue, and the disease generally proves fatal before the lapse of three or four weeks.

Symptoms of Chronic Glanders.—Chronic glanders may continue for many months without obviously affecting the general health of the animal. It differs from the acute form of the disease in the facts that its local phenomena are more important and numerous, and that the constitutional symptoms are more trivial and variable. The chronic form, differing from the acute form, is more liable to develop constitutional signs at the later, than during the earlier, stages of the disorder. Usually there is a discharge—never absent where nodules or ulcers are developed—from one or both nostrils. The discharge is at first like that of common catarrh, but it gradually becomes thicker, viscid, pasty, and mingled with greenish yellow purulent matter, and has a tendency to adhere round the nasal orifices. Pathological changes similar to those described under the acute form occur in the mucous membrane of the nose, and in addition, parts of the latter occasionally become denuded of epithelium, the place of which is taken by a soft granular substance.

There is great tendency for the lesions not to heal, but to progress, and spread to the cartilage and the bone. The ulcerated and denuded surfaces may heal by cicatrization, the cicatrices themselves being sometimes slightly depressed. Although the nasal ulcers may heal, yet the disease may still remain, and nodules be present in the lungs and elsewhere. Eventually, also, the nasal ulcers may again resume activity.

Even when the sores have cicatrised the power of infection is not lost.

The lymphatic glands in the intermaxillary space enlarge, and are somewhat painful, but become gradually indurated, fixed to the jaw, and distinctly nodulated.

Chronic glanders is liable suddenly to manifest acute symptoms, especially during the latter stage of the disease.

ACUTE FARCY.

Definition.—Farcy is a form of glanders in which the cutaneous connective-tissues and superficial lymphatics, generally or conjointly, are especially liable to be involved. This disease usually affects one limb, either fore or hind, perhaps generally a hind limb.

Cause.—Farcy occurs as the result of direct inoculation with the discharges of farcy or glanders, or from infection, and is said by some to arise *de novo* as the result of debilitating influences and mal-hygienic conditions, though this seems to us most improbable.

Symptoms.—The first symptoms are those of fever. Rigors set in, and elevation of temperature to 106° or even to 108° may occur, but this height is not often reached. There are local swellings, generally confined to the extremities. They manifest themselves by engorgement of a whole limb, and resemble the swellings of acute lymphangitis. The engorgement appears as a generally diffused swelling, involving the cutaneous and underlying tissue, and the limb is hot and painful, and there is marked lameness. As the general œdema subsides, specific nodules, 'farcy buds,' and an enlarged condition of the veins and lymphatics become more manifest. Sometimes the œdema is not so generally diffused, but occurs in localised circumscribed forms, on which the specific buds arise. The lymphatics reaching from these buds to the lymphatic glands, or reaching from one bud to another, become enlarged and corded. The nodules generally appear in the œdematous tissue somewhat suddenly, and are situated in the skin or the subcutaneous tissue, and may extend even to the muscles. They vary in size from a pea to a marble, and are not sharply differentiated from the surrounding tissue. In a few days the buds disintegrate and the sores are formed. These farcy ulcers, several of which may coalesce, are deep, with ragged edges, and tend to extend and discharge an abundant creamy fluid tinged with blood.

As in the ulcers of glanders above described, the floor and sides of these rodent sores of farcy are covered with rounded elevations resembling vascular granulation-tissue.

Distinct nodules, which soften and discharge a yellowish purulent fluid, develop in the painful, swollen, and corded lymphatic vessels. The ulcers thus formed have likewise a tendency to coalesce. The swollen and nodulated lymphatic glands themselves, as in glanders, very rarely suppurate.

The fever, which is of either the remittent or the hectic type, is liable to exacerbations marked by rigors and localised perspirations, and emaciation and prostration are marked.

Not uncommonly, acute glanders is developed in these cases.

CHRONIC FARCY.

Chronic farcy differs from the acute form only in intensity and duration. It is a very common form of equinia, and is more amenable to treatment than the other manifestations. The special features are eminently local. Fever, when present, is more remittent than in the acute form, and the constitutional symptoms are not so severe. In this disease, circumscribed inflammatory nodules, which vary in size, are developed in connection with the skin and subjacent tissues. They afterwards soften, ulcerate, and discharge a purulent fluid, and the ulcers have little tendency to heal. The nodules are especially liable to invade the skin where it is thin and vascular, as over the facial, maxillary and laryngeal regions, and along the neck, thigh, forearm, and flank. The lymphatic vessels and glands are also affected as in acute farcy, but the vessels are less liable to become nodulated, and the infiltrated state may remain in an indolent condition and eventually disappear. The glands themselves are not so painful nor so much swollen and infiltrated, and suppuration follows more rarely than in glanders or acute farcy.

Morbid Anatomy, Diagnosis and Treatment of Equinia.

Morbid Anatomy. The glanderous nodules which were mentioned as being found in the pulmonary tissues are of the size of a millet-seed, and grow in the connective-tissue of the lung, and are subject to fatty, caseous, and calcareous change. On section they are of a translucent pearly-grey colour, surrounded by a zone of inflamed tissue. In structure they are identical with those found in the nasal cavity; but the latter, not being imbedded deeply in tissue, more readily ulcerate and discharge.

There remain for consideration two forms of morbid change, which, though important, are not frequently met with, viz.:

1. **Tumours, or Abscesses.**—These are generally found on the more exposed parts of the body: the scapular region, sides, and haunches. They are quite distinct from the nodules above described, and are larger, more defined, and less prone to ulcerate. They bear a greater resemblance to ordinary cysts or abscesses than to the specific lesions of equinia; but in the contained fluid, in disposition to fill when emptied, and in the slowness of healing, they agree with the latter.

2. **Diffuse Infiltrations.**—These infiltrations are usually situated in the limbs in the neighbourhood of the joints, and usually accompany the pseudo-rheumatic symptoms. They exhibit a tendency to rapid change of situation, appearing in connection with some other joint, and in this they resemble the rheumatic inflammations.

Diagnosis.—The diagnosis of equinia is usually not attended with difficulty; but in some cases, especially in those of pulmonary glanders, it is not always easy to arrive at a definite conclusion.

Glanders is now of far less frequent occurrence in this country than it formerly was, and this is largely due to the adoption of measures based upon its undoubtedly infectious character, and the management of horses in accordance with this idea.

Treatment.—Animals affected with the various forms of equinia are, in the interests of the community, destroyed, in order to prevent further spread. The rules of the Contagious Diseases (Animals') Act are to be carefully observed. The stables should be thoroughly disinfected with sulphurous oxide gas, or by means of chlorine generated by the action of sulphuric acid on calcium chloride or bleaching powder (chloride and hypochlorite of calcium). The walls of the stables are thoroughly washed and scraped, and may be cleansed with lime-wash containing one pint of carbolic acid in each bucketful. The harness and fittings and other articles which have been in contact with the animal should also be thoroughly cleaned with carbolised water.

Remedies.—The remedies which have been used in equinia are arsenic, iodine, cupric biniodide, potassium iodide, sodium sulphite, and many others.

Of all internal medicines, iodine is in all probability the most potent in the various forms of equinia. It has been given in acute glanders in man with success, and has also been administered in many cases of the acute form in the horse.

VARIOLA EQUINA.

Synonyms.—Horse-pox; constitutional grease; variole du cheval; pferdepocken.

Definition.—Variola equina is a mild specific fever, accompanied by the development of an eruption which passes through a papular, vesicular, and pustular stage, and is preceded by a period of incubation during which no abnormal phenomena are manifested.

Incubation varies from four to eight days.

Diagnosis.—This disease has been mistaken for glanders and farcy, and also for eczema and impetigo.

Contagium.—Is propagated by direct contact, and probably also by infection. It may be produced by artificial inoculation in the horse and other animals, but the susceptibility of the horse to the virus of variola is greater than that of cattle and sheep. The virus obtained from the vesicles and that in the saliva and crusts is especially potent. Whether one attack secures immunity against future ones or not is uncertain.

Symptoms.—Two or three days before the eruption develops, there may be mild fever and signs of impaired health, but these preceding symptoms are in most cases unnoticeable. The eruption commences as indurated red papules, circular in shape, and shortly becoming depressed in their central portions, and encircled by a bright red areola. In a few days the papules become vesicular, and contain a clear fluid which soon becomes more opaque.

Lastly, a scab forms, which if accidentally detached, discharges a limpid fluid, and leaves a depression, which gradually fills by granulation.

If the scab be not detached by force, healing by cicatrization, with little or no suppuration, will be accomplished in fifteen to twenty days.

During the period of eruption, and even after desiccation, there is usually considerable swelling of the limbs and inferior surface of the abdomen.

The swelling may remain for several weeks after convalescence.

Sometimes the pustules become confluent, and large ulcerating surfaces are then produced, causing death of large portions of the skin and subcutaneous tissue.

Situation of Eruption.—The eruption is especially seen on the extremities, from the knees and hocks to the feet. The hind limbs especially are liable to be affected, and often swell.

Other seats of eruption are the muzzle, lips, nostrils, the mouth, sides of the tongue, and the nasal mucous membrane.

In these places the spots are smaller than those on the extremities; and with their presence are associated salivation, impaired mastication, considerable fever, and swelling of the submaxillary glands.

The eruption may be distributed over the whole body. Complete restoration to health is often retarded by the development of a secondary eruption of spots, or by complications.

Prognosis.—Is usually favourable. The disease generally lasts about fifteen to twenty days from the time of infection to the desquamative process. The eruptive stages extend over a period of eight days of this time.

Treatment.—Attend to the hygienic conditions.

Salines and fever medicines may be administered, and the diet should be laxative.

If the mouth is sore, gargle with carbolic acid solution (1 part in 150 of water), or with a weak solution of zinc-sulphate or sulphurous acid.

ERYSIPELAS.

Synonym.—St. Anthony's Fire.

Definition.—Erysipelas (ἐρύω, *I draw*, and πελάς, *near*), is a specific febrile disease, accompanied by inflammation of the skin, and—in most cases—the subcutaneous tissues, with an eruption, not developed in every case; much pain, heat, and swelling.

Varieties.—(1) Simple cutaneous; (2) Cellulo-cutaneous, or phlegmonous; and (3) Cellular erysipelas.

Etiology.—Erysipelas is more liable to attack the weak and debilitated, and is probably due to some specific poison.

When occurring in association with an injury, it is termed *traumatic*, and when appearing spontaneously it is termed *idiopathic*.

With the traumatic variety it is our purpose to deal in the manual of equine surgery. The cellulo-cutaneous, or phlegmonous, form is the one most frequently met with in the horse. It is rather malignant, and involves the skin, subcutaneous and other tissues. The simple cutaneous form is rare, and, when it does occur, is a mild affection.

Symptoms.—These are : (1) general, and (2) local.

1. General Symptoms.—The fever, when occurring in young and in strong horses, is usually of the sthenic type, while in the older and in the debilitated animals it is of the asthenic or adynamic type. In all except the mildest cases it tends to pass on to a low prostrating form. The fever is ushered in by a rigor ; the temperature is raised, and there is muscular pain. The mouth is hot, the tongue furred, the breath has an acrid smell, and the bowels are confined.

2. Local Symptoms of the Simple Form.—Consist in redness (not easily observable in the horse), roughness, and slight swelling of the skin, which pits on pressure, accompanied by the formation of vesicles and frequently by serous infiltration of the subcutaneous tissue. Desquamation follows.

Local Symptoms of the Phlegmonous Variety.—The effusion into the subcutaneous tissues is at first serous, and the swelling pits on pressure. With the progress of the disease the parts become harder, more brawny, and more painful; and the local tension of the skin is increased.

Numerous vesicles, or phlyctenæ, preceded and accompanied by serous exudation, may be developed. They do not occur in every case, but when formed are a characteristic feature of erysipelas.

In the severer forms the serum of the vesicles becomes bloody and albuminous.

The inflammatory action going on in the subcutaneous tissue may terminate in suppuration, and the pus formed may burrow in the meshes of the connective-tissue. Thus large portions of skin and tissue may be destroyed. If, however, the inflammatory action is not excessive, the effusion is absorbed, and the vesicles speedily desiccate and form scales, which separate in time. In cases of a very severe type, sloughing of the tissues may spread to the more deeply-seated structures, and involve the muscles, ligaments, sometimes even leading to necrosis of the bones.

In some cases the pus may find its way into the joints, causing their disintegration, and producing constitutional disturbance so serious as to prove fatal.

The mucous membrane of the mouth and nose may also become affected. In phlegmonous erysipelas the fever is very severe. The pulse is quick and feeble; the respirations are hurried, and the pain is intense.

A six-year-old gray cart-horse, of plethoric constitution, belonging to a contractor, accidentally fixed his leg in the mud of a dike. The horse was removed to a stable, and the leg was then found to be much swollen and very painful. The owner applied a strong embrocation for two days, thinking to do good, but really intensifying the mischief. During this time the swelling had rapidly increased. Having been called in, on the third day I found the near fore-leg enormously swollen and engorged. The skin itself was very red, and it was covered with distinctly-marked yellow vesicles as large as half a bean. The pulse numbered 96, and the temperature rose to 104·7° F. The respirations numbered about 48. All treatment was found to be futile, and the animal died about thirty-four hours afterwards.

Prognosis.—The milder forms may terminate favourably by desquamation in ten to fourteen days.

The phlegmonous variety, in which the fever is of a typhoid character, is in most cases fatal.

The cellular form is very rarely seen in the horse.

Diagnosis.—Erysipelas may be confounded with scarlatina, acute farcy, and lymphangitis. Yet by carefully noting the symptoms, they are easily distinguished.

Treatment.—The patient should be placed in a well-ventilated loose box, and a mild purge of calomel or aloes, or both, may be given. We may then administer liquor ammoniæ acetatis, with camphor and nitric ether, three times daily. If the temperature be very high, salicylic acid may be tried, in full doses, twice or thrice daily. The tincture of perchloride of iron is recommended by some from the earliest onset of the disease. In the human subject this remedy is regarded as a specific in erysipelas.

As the disease progresses, stimulants become necessary; and aromatic spirit of ammonia, in doses of 2 ounces, or whisky, in doses of 3 or 4 ounces, may be given three times daily. Quinine may also be given, and other vegetable tonics. Potassium chlorate may be dissolved in the water during the acme of the fever, if the thirst be great.

Local Treatment.—Foment for two hours, three times daily, with warm water. When exudation has taken place into the subdermal tissues, free scarification is recommended by some. If abscesses form, they should be freely incised, so as to allow of the escape of pus, and the parts should be dressed with carbolic solution (1 part in 40).

Raw surfaces, and unhealthy sores especially, should be kept thoroughly clean by antiseptic solutions.

CEREBRO-SPINAL FEVER.

Synonym.—Epizoötic cerebro-spinal meningitis.

Definition.—Cerebro-spinal meningitis is an acute specific febrile disease, often assuming the form of an epizoötic, and affecting in particular the coverings of the brain and spinal cord.

Etiology.—The cause of this malady is not known. It is especially prevalent in America, where dietetic errors are said by some to produce it.

It is most probably due to some specific germ.

Symptoms.—The symptoms usually come on suddenly. They begin with dizziness and vertigo, quickly followed by total loss of motor power, which is often so complete and sudden that the horse falls prostrate to the ground.

The pulse and respirations are accelerated; there is often hyperæsthesia, or increased nervous sensibility, especially at the anterior part of the animal, and clonic contraction of the superior cervical and dorsal muscles, passing in some cases to opisthotonos.

In most cases, although the wild look of the eyes and injected conjunctivæ indicate that the cerebrum is affected, yet consciousness is not usually impaired. When, however, the cerebrum is more deeply affected, coma with slow pulse and stertorous breathing follow. The bowels are constipated; the urine is often suppressed, and there may be incontinence, especially in mares. Pressure over the spine causes pain. The temperature is variable. It may, or may not, be elevated, and is intermittent.

In mild cases, which may be met with at any time during, but usually occur towards the close, of an epizoötic, the leading symptoms are not so quickly developed. There may be pulmonary complications in this fever, and when this occurs the danger is increased. Priapism in horses and œstrum in mares are of frequent occurrence.

Morbid Anatomy.—Pathological lesions are especially marked in the membranes of the brain and spinal cord, which are found highly congested. The fluid of the sub-arachnoid space is turbid, and increased in amount, and all the vessels of the brain and cord are often congested.

In many cases patches of ecchymoses are found on the dura mater.

Prognosis.—If the symptoms come on slowly, the prognosis is, as a rule, correspondingly less grave. The number of fatal cases is large, and so the prognosis should always be guarded. The mortality may be as low as 10 or reach as high as 70 per cent., or even higher.

At the beginning of an epizoötic the percentage of fatal cases is said to be higher. Even when a case is apparently progressing favourably, a relapse may occur.

Treatment.—If practicable, it is advisable to sling the animal as early as possible. The extremities should be kept warm. Cathartics, *e.g.* aloes, with or without salines, may be given. Belladonna and ergot have been found of much benefit. The former may be administered hypodermically in the form of sulphate of atropia.

During convalescence, vegetable tonics with iodine may be given, and if paralysis remain, doses of strychnine, iron and quinine should be administered. Electricity also may be tried. In cases of great prostration, quinine or cinchonine and alcoholic stimulants are useful.

Locally, apply ice-bags to the spine, or hot water, as recommended by Dr. Chapman.

The spine may also be rubbed with stimulating liniments.

The diet should be nourishing and laxative.

No case of this fever has been, so far as we know, recorded in England, except that a few cases are said to have been seen at one time in London and other large towns. However, the disease seems to have made no headway in this country.

ANTHRAX.

Synonyms.—Splenic fever; charbon; charbone; malignant carbuncle; gloss-anthrax; carbuncular fever; milzbrand (German); carbone (Italian); jaswa (Russian).

Historical Review.—Anthrax is mentioned in the Scriptural narrative as the 'blain,' which affected both man and beast. It is described by the Greek and Latin writers. The former termed the disease *οἰδημα* when occurring in animals, and *ἄνθραξ* when affecting man. The Latin writers termed the disease *sacra ignis* in animals, and *carbunculus* in man.

Anthrax, though now of rare occurrence among horses, frequently raged as a malignant epizoöty throughout Europe, in past times. The seventeenth and eighteenth centuries were remarkable for the devastations made by many epizoötic outbreaks of anthrax.

In 1617 it was of such a fatal type, that around Naples over 60,000 persons perished from partaking of the flesh of animals which had died of the disease.

In 1731-32 an epizoöty of glossanthrax raged among the domesticated animals in the States of Central and South-Western Europe.

The years 1757, 1763, 1779, 1780, and 1800 were marked by a charbonous malady, which extended nearly all over France, and affected all the domesticated animals.

'The contagiousness of the disease has been recognised for several centuries. The bacilli of anthrax were first alluded to by Delafond in his "Traité sur la Maladie du Sang des Bêtes à Laine," in the year 1845. It was in 1849 and 1855 that Pollender drew special attention to these organisms. Branell, of the Dorpat Veterinary Institution, also threw much light upon them in 1857 and subsequently' (*Veterinary Journal* for 1885, vol. xx., p. 264).

Geographical Distribution.—Anthrax is of universal distribution, no clime being exempt from its ravages. As an epidemic and epizoöty among men and animals, it breaks out in Siberia, where it is termed the 'Siberian plague.' As 'Loodianah disease,' it is of frequent occurrence in Central Hindoostan. In Australia it is termed 'Cumberland disease.' It is also met with in North and South America, and Central and Southern Africa. Anthrax occurs in marshy districts in Lincolnshire, especially in the Fen-country, where the soil is black, and contains much vegetable material, and old and decayed timber. Large trunks of trees may sometimes be dug out.

Definition.—Anthrax is an acute infective disease, of rapid development and extreme fatality; appearing usually in an enzootic form; affecting all animals, including birds and fishes, but more especially solipeds and ruminants, and characterized by the presence and rapid multiplication of the bacilli anthracis in the blood and tissues.

Etiology—Direct Causes of Anthrax.—The immediate cause of this disease is the entrance of the bacillus anthracis into the blood, and its development there.

These vegetable organisms may gain entrance into the system by direct inoculation, by the digestive tract, or by the air-passages.

Predisposing Causes.—Anthrax is especially prevalent in low-lying, swampy districts, where the soil is rich in organic matter and salines; these conditions being in the highest degree favourable to the growth and development of these low forms of vegetable life.

The same influences also may act upon animals, rendering them more fitted for the reception of these germs, and we know, from many experiments, of what great significance the nature of the soil or pabulum is to the growth and multiplication of bacteria. We may mention three instances:

Fowls were once believed to possess an immunity against anthrax. Now, M. Pasteur showed, by immersing fowls in water and thus lowering their temperature, he was able to inoculate them with the disease, though when not thus immersed he was unable to induce the development of anthrax in them.

Again, rats, when fed on animal diet, resisted inoculation, while others, fed on bread, readily contracted the disease.

Chauveau was unable to inoculate Algerian sheep by the ordinary method, though virus from the same vessel readily induced the disease in other sheep.

These experiments illustrate clearly of what importance the nature of the soil is to the growth of the germs placed in it. Animals in which no other disease is present, and those in a plethoric condition, are especially liable to attack, and young animals, also, are more likely to contract the disease than older ones. And it is in those warm, low-lying, marshy districts, where food especially rich in nutritive value is grown, and where, in consequence, animals are best nourished, that they afford a more genial soil for the reception of these vegetable parasites.

Again, it has been shown in many cases in moist districts, where anthrax has been long endemic, that after thorough drainage the disease disappeared entirely.

A hot, stifling atmosphere, charged with electricity, is said also to favour the development of these germs.

Modes of Propagation of this Disease.—Many attacks have been traced to the indiscriminate burial of diseased carcases. According to M. Pasteur, the spores of the bacillus are brought to the surface by earth-worms, even ten to twelve months after burial of diseased carcases; but this method of propagation is doubted by some.

Dogs, after feeding on diseased flesh, may bite sheep, and thus inoculate them with the disease.

Flies feeding on anthrax blood have been shown to absorb sufficient poison in their proboscides to give the disease to animals inoculated with the contents.

Anthrax may be spread by eating contaminated food, by water percolating the soil and carrying with it the germs of the disease. Knives uncleaned may also propagate the disease.

The germs are said to be more volatile in spring and summer, less so in autumn, and still less in winter.

Although anthrax has not been shown to be infectious, yet there is every probability that it is. The disease often first appears in districts where it may be enzoötic, and then assumes an epizoötic form.

Incubation.—Varies from a few hours to one, two, or even four days.

Symptoms of Anthrax, without Special Localization, or Anthrax Proper, or Anthrax Fever, or Anthrax Apoplectica.—This disease is rare in Great Britain. The symptoms appear suddenly. The horse has violent muscular tremors, perspires freely, and breathes with difficulty and irregularly. There is complete loss of control of the muscular movements, especially of the lumbar muscles, and those of the posterior limbs in particular. The animal staggers and dies convulsed. These acute symptoms, especially those of nervous complications, may, however, abate in two or three days, and finally end in death or recovery. However, the symptoms are not always so rapidly developed. They may begin with small, weak, and dicrotous pulse, uneven surface temperature, and violent tumultuous action of the heart. The internal temperature is high, but generally falls before death; the conjunctival membrane is swollen and of a yellowish-red hue. There is disinclination to move, inco-ordination, and loss of power in the muscles of locomotion, and twitching of the muscles in various parts. Drowsiness and stupidity, with much prostration, are marked symptoms. There is a yellowish discharge from the nose, often tinged with blood, and the nasal membrane is often covered with blood extravasations.

The breath is fœtid and the superficial lymphatics swelled; abdominal pain, shown by uneasiness, pawing, and looking to the sides, is sometimes manifested. The fæces are fluid or blood-stained; the skin is harsh and dry, and in some cases it crepitates when pressed towards the loins or sides. The respiration becomes tumultuous and hurried, the nostrils dilate, and the animal foams at the mouth. The temperature declines, the animal staggers at every step; convulsions, and delirium or coma ensue, and death closes the scene.

Diagnostic Symptoms of Anthrax.—The most valuable and reliable are the rapidity of the onset and of the swelling, and the swiftly fatal issue. In many cases the lungs are affected. All parts of the head, the sides of the face, and of the neck, are swollen. Nearly all the tissues after death are found to be of a deep-red colour, and most of the organs seem to be blood-stained with sanguineous effusion.

Symptoms of Anthrax with Localization.—Anthrax in horses is not so frequently marked by local symptoms as in the ox and sheep.

'Nevertheless, a critical eruption of so-called anthrax tumours is sometimes present in certain epizoöties, in which horses, as well as other herbivorous animals, are involved' (Fleming).

At a certain stage in the febrile symptoms there is an external eruption in various regions. This consists in the development of 'tumours' or 'anthrax-pustules' in the interstices of the muscles, in the loose areolar tissue, and in the lymphatic glands. They are especially met with in the submaxillary space, in the upper part of the throat, the lower part of the neck, behind the shoulders, on the back, and in the inguinal region.

They may appear as small rounded nodosities, about the size of a walnut, and having as it were a pedunculated base.

In other cases the tumours appear suddenly as large, soft, crepitating, undefined swellings, and invade many surrounding parts. As they rapidly extend, they become cold and insensible, and vesicles or phlyctenæ appear on the surface. These vesicles, quickly bursting, discharge an irritant serous fluid. If the hand be passed over these swellings, crepitation may be felt. This is due to gas from the decomposition of the tissues collecting in the connective-tissue, and thus rendering the part emphysematous. This is a special feature of the tumours of anthrax.

Sometimes the tumours appear without being preceded by any very marked symptoms, and their course is in all cases the more rapid the earlier they make their appearance. In two to eight hours they attain a large size, and the surrounding tissues mortify as they are invaded.

As the tumours are developed, the fever abates and the urgent symptoms vanish. When they have attained a certain proportion, general symptoms are developed, which vary according as the malady takes a favourable course or not.

In some rare cases the tissue of the tumours is suddenly absorbed, and abundant sweats and fetid diarrhœa ensue, and the animal recovers rapidly. In some cases the tumour disappears by resolution, but generally the tumours vanish, and coincidently the disease assumes all the characters of anthrax fever without local manifestations; the general symptoms reappear, and the horse dies in about twelve hours.

ANTHRACOID DISEASES.

There remain for consideration two forms of anthrax characterized by pathological lesions of special parts. These are glossanthrax and anthracoid angina.

Glossanthrax does not lead to such a rapidly fatal issue as does anthrax itself. Horses suffering from anthrax may die in less than twenty-four hours; but in cases of glossanthrax death may not occur for three days. Neither form is common, and both are generally found associated. By some authors they are termed anthracoid diseases (*ἀνθραξ* and *εἰδος*, like).

Glossanthrax.—The local symptoms which are rapidly developed in glossanthrax probably slightly precede the general disturbance of the system. Glossanthrax is a rare disease, and is generally associated with anthracoid angina. There is an eruption of vesicles, or phlyctenæ, on the sides, dorsum, and sometimes on the frœnum of the tongue, and on the buccal membrane of the mouth and lips.

The vesicles vary in size from a nut to a hen's egg, and contain at first a clear yellowish serum, which gradually becomes of a brownish-black colour. They rapidly increase in size, and break, and the acrid contents are discharged, being mingled with the abundant flow of saliva.

The tongue itself is swollen and hard, hanging from the mouth, and is of dark bluish or black hue.

It is often lacerated by the teeth, and deglutition becomes difficult, and the animal is soon unable to swallow fluids.

When the vesicles have burst, they leave an unhealthy ulcerated surface, which often has a gangrenous appearance, and becomes coated over with a yellowish exudation. This is removed, and exposes the ulcerating sore.

The vesicles usually form a few hours before death, and the constitution, previously not affected, becomes seriously so, and the animal usually dies in twelve to twenty-four hours. The condition of the tongue is often associated with inflammation and swelling of the throat and the structures around the throat—anthracoid angina.

The following article on 'Glossanthrax' appeared in the *Veterinary Journal* for 1885, vol. xx., pp. 86, 87:

'It is noteworthy that, whereas cases of anthrax proper, or anthrax fever, affecting the horse, are not uncommon in certain districts in the county of Lincolnshire, cases of localized anthrax are decidedly very rarely met with in the equine species.

'Indeed, during the last three years, though I have had under my notice no less than thirteen cases of anthrax proper in the horse, the case to which it is my purpose to draw attention is the first example of localized anthrax in the horse which I have encountered in North Lincolnshire during the same period.

'On Sunday evening, December 14, I was called to see a two-year-old bay cart filly belonging to a gentleman residing in the Wold-land, a distance of six miles from Louth.

'The animal was in good condition, and had only recently been brought up from grass.

'On careful examination, it was manifest that the case presented the characteristics of glossanthrax and anthracoid angina. The sides of the cheeks and tongue were very much swollen, and were of a dark, purplish-brown hue. The tongue was hanging from the mouth, and protruded about six or seven inches. There was a copious eruption of phlyctenules on the sides and dorsum of the tongue, and also on the buccal membrane of the lips and mouth. Thick, yellow-coloured serous fluid was discharged in abundance from the mouth and nose, and the breath was fœtid. The throat was swollen, hot, and painful, and deglutition was quite impossible. The pulse, which was very feeble, numbered eighty beats per minute, and the respiration was hurried and difficult. The temperature reached 105° F.

'On the following morning the symptoms were still more exaggerated. The head and neck were immensely swollen; the tongue, still hanging pendulously, almost completely filled up the cavity of the mouth. The buccal membrane was eroded in patches, as also was the dorsum of the tongue, and yellow serum tinged with blood oozed from the mouth. The pulse was fluttering and almost imperceptible, the legs and ears were cold, the nostrils were dilated, the breath was very fœtid, the respiration was hurried and very difficult, and the animal seemed about to succumb.

'The swelling in the region of the head and face more especially affected the cheeks, the body and base of the tongue, and the tissues of the submaxillary, parotid, and laryngeal regions.

'As there was no prospect of recovery, the animal was shot.'

The following is taken from the *Veterinary Journal* for 1886, vol. xxiii., pp. 321-324:

'In the *Veterinary Journal* of February, 1885, I described a case of glossanthrax and anthracoid angina in a two-year-old bay cart filly, to which I was called on December 14, 1884. Since that time I have only seen one other case of this dreadful disease. In both the symptoms were very similar, but it is only in the latter case that I made a special pathological examination, with the view, if possible, of throwing some light on the nature of this terribly malignant malady. Dr. Albert Gresswell kindly conducted the microscopical investigation. It is noteworthy, in the first place, as I pointed out in the number of the *Veterinary Journal* above mentioned, that whereas cases of anthrax proper, or anthrax fever, affecting horses, are not at all uncommon in North and Mid Lincolnshire, cases of glossanthrax are decidedly very rarely met with in the equine species.

'Indeed, until recently, I should think that anthrax was more common in Lincolnshire than in many parts; but owing to the fact that now so many of the fields on which anthrax was endemic have been by our advice thoroughly drained, it is much more rarely met with in this district than it was several years ago.

'The subject of the first case of glossanthrax was in good condition, and had only recently been brought up from grass. The sides of the cheeks and the tongue were much swollen, and were of a dark, purplish-brown hue. The tongue was hanging from the mouth, and protruded about six or seven inches. There was a copious eruption of phlyctenules on the sides and dorsum of the tongue, and also on the buccal membrane of the lips and mouth. Thick yellow-coloured serous fluid was discharged in abundance from the mouth and nose, and the breath was fœtid. The throat was swollen, hot and painful, and deglutition was quite impossible. The pulse, which was very feeble, numbered eighty beats per minute, and the respiration was hurried and difficult. The temperature reached 105° F. On the following morning the symptoms were still more exaggerated. The head and neck were immensely swollen; the tongue, still hanging pendulously, almost completely filled up the cavity of the mouth. The buccal membrane was eroded in patches, as also was the dorsum of the tongue, and yellow serum tinged with blood oozed from the mouth. The pulse was fluttering and almost imperceptible, the legs and ears were cold, the nostrils were dilated, the breath was very fœtid, the respiration was hurried and very difficult, and the animal seemed about to succumb. The swelling in the region of the head and face more especially affected the cheeks, the body and base of the tongue, and the tissues of the submaxillary, parotid, and laryngeal regions. As there was no prospect of recovery, the animal was shot.

'The subject of the second case, to which I was called on October 14, at 8 a.m., was an aged brown cart-horse, belonging to a gentleman-farmer who resides on the Wold-land at a distance of about eight miles from Louth.

'The animal had quite recently been brought up from grass, and was noticed on the 13th to be dull and feeble, refusing all food, and discharing mucus from the nose and saliva from the mouth.

'On the morning of the 14th I found the horse to have refused all food. He was standing in a corner of the loose-box champing with his teeth, and discharging a large quantity of frothy saliva from the mouth. After a careful examination, I found his pulse to be feeble, and in number ninety-six per minute. The temperature was 104·8°, and the respirations were twenty-seven per minute. Examination of the mouth showed the tongue and buccal mucous membrane to be very much swollen and hot. The under-surface of the tongue was denuded of epithelium in patches. The parotid and submaxillary glands were considerably swollen, and the lining of the nose was highly injected, as also was the conjunctival membrane. The discharge from the nose and mouth varied greatly in amount.

'The horse was treated with antipyretic and antiseptic remedies, and all solid food was taken away, gruel only being allowed. He was caused to breathe medicated water-vapour. The throat was well fomented, and anodyne and stimulating liniment was applied.

'As there was constipation, a mild aperient was administered. At 7.30 p.m. on the same day, the horse was reported by the manager of the farm to be worse. In my absence, my late assistant, Mr. O. G. Barrow, M.R.C.V.S., a most diligent observer, went over, and, after a careful examination, found that no further symptoms of serious consequence had supervened. The case was, perhaps, slightly better. The temperature was 104·5°, and the pulse eighty-four.

'On the following morning I found the animal to be very much better. The pulse was seventy-two, and the thermometer recorded 102·3°. During the previous night, the animal had drunk his gruel, and eaten a little watery mash.

'There was no perceptible discharge from either the nose or mouth, and the horse swallowed his gruel, and took his medicine easily. At five o'clock p.m. on the same day the case began to get worse; the tongue commenced to swell rapidly. On the 15th I found the case to present every symptom of glossanthrax. The tongue was enormously engorged, and protruded about six inches from the mouth. The surface was of a yellowish-brown colour, and the sides were of a purplish-red, and in some parts almost black. The saliva was of a rusty, reddish tinge. (The citron-yellow secretion mentioned, so characteristic in the former case, I did not observe in this animal.) The under-parts of the tongue presented large excoriated and gangrenous patches. The whole of the head was swollen and œdematous (the swelling did not pit on pressure, but was remarkably firm), especially around the nares and about the eyelids. The submaxillary space and the whole of the throat were enormously swollen. The pulse was almost imperceptible, fluttering, and irregular. The temperature was 105·3° F. The respirations were laboured and roaring, and the expired air was intensely fœtid, so much so, indeed, that it was only with great difficulty that the attendant could be induced to come into the box with me.

'The animal was then shot. After an examination, the carcase was buried. So far as we are able to judge, the chief point of resemblance between glossanthrax, anthracoid angina and anthrax fever, is the intense malignity of these diseases.

'Beyond this, they are apparently not related, so far as we can judge. It is therefore difficult to see why the name glossanthrax or anthracoid angina should be retained. The disease is not like anthrax, and therefore the term *anthracoid* is inaccurate. The term malignant or septicæmic glosso-laryngitis would be preferable. Another reason for discarding the terms *anthracoid* angina and glossanthrax is that black-leg of cattle is also called anthracoid, and thus a kind of intimate relationship might be supposed to exist between the diseases which perhaps does not exist.

'We are only speaking of horses; we do not here give an opinion concerning the so-called *anthracoid* diseases of cattle.

'In the flesh, tissues, and exudations in this case we have found rod-shaped bacilli, not unlike those found in malignant œdema. At present, of course, it would be impossible to state that this bacillus is satisfactorily proved by us to be the cause of glossanthrax, because only the first of Koch's conditions has been fulfilled. That bacilli have been found in portions of the tongue, we can definitely state. Koch's conditions are: (1) It is absolutely necessary that the micro-organisms in question be present either in the blood or in the diseased tissues of man, or of an animal suffering, or dead from the disease. In this respect, great differences exist, for in some infectious diseases the micro-organisms, although present in the diseased tissues, are not present in the blood; while in others they are present in large numbers in the blood only, or in the lymphatics only. (2) It is necessary to take these micro-organisms from their nidus, from the blood or the tissues as the case may be, to cultivate them artificially in suitable media, *i.e.*, outside the body, but by such methods as to exclude the accidental introduction into these media of other micro-organisms; to go on cultivating them from one cultivation to another for several successive generations, in order to obtain them free from every kind of matter derived from the animal body from which they have been taken in the first instance. (3) After having thus cultivated the micro-organisms for several successive generations, it is necessary to reintroduce them into the body of a healthy animal susceptible to the disease, and in this way to show that this animal becomes affected with the same disease as the one from which the organisms were originally derived. (4) Finally, it is necessary that in this new animal affected in this way, the same micro-organisms should again be found. A particular micro-organism may probably be the cause of a particular disease; but, that really and unmistakably it is so, can only be inferred with certainty when every one of these *indispensable conditions* of proof has been satisfied.

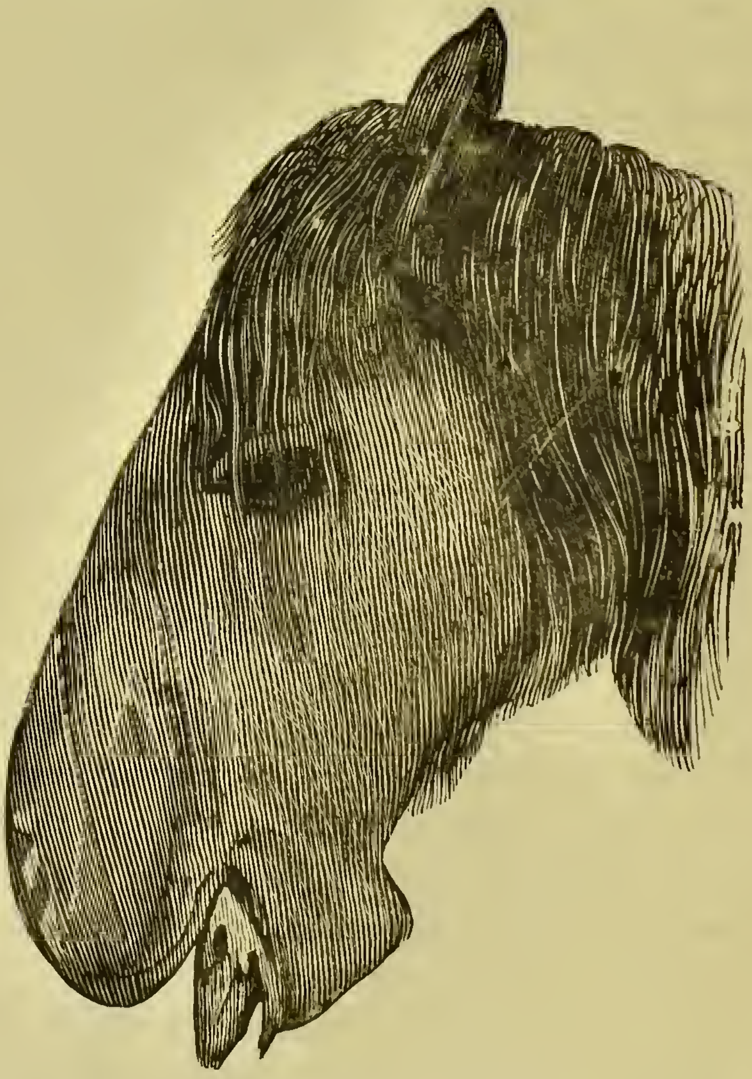
'The writers, having but little time for pathological investigation, must apologize for the incompleteness of the above observations, but trust they will be of some utility.'

The following is taken from the *Veterinary Journal* for 1887, vol. xxiv., pp. 156-158:

'Glossanthrax has been more prevalent in North Lincolnshire of late than I have ever known it to be since the commencement of my connection with veterinary medicine.

'On this account I think, therefore, that a short description of a virulent case of the disease in a three-year-old colt may prove of great interest to the readers of the *Veterinary Journal*, more especially as we have at length identified, beyond any doubt, the vegetable germ which causes this dread malady, fortunately not a very common one at any time in our country. We ought to mention that Mr. Richard Burke has investigated this disease in India, and this skilled veterinarian has informed us that he had anticipated us in demonstrating the nature of the disease, and in discovering the germ to which it owes its origin. Mr. Burke's work is so good and thoroughly done, that it is a pleasure to us to find our opinions corroborated by him.

'The case of which I now propose to speak was one in which the first symptoms of impaired health showed themselves on the morning of January 19, 1887. The attendant on that morning noticed a slight swelling on the lips and tongue, and he informed me that on the previous evening there were no symptoms whatever of ill-health impending. The young animal had been running loose in an open crew-yard with several other young horses, which



up to the present time have manifested no symptoms whatever of disease.

'I first saw the colt on the evening of the 19th, when I found the tongue to be enormously swollen, filling the cavity of the mouth; the breath was extremely fœtid; the pulse was feeble and fluttering, and in number reached 108 per minute. The temperature was 104·7° F. The sides of the face and throat were much swollen, and there was a profuse flow of saliva. The respirations were hurried and laboured. From the first I regarded the case as hopeless.

'On January 20, the animal still lived. All the symptoms were much aggravated. The pulse was almost imperceptible, and the odour of the breath was unbearable. The eyelids were much tumefied, occluding the eyes. The discharge from the mouth was profuse, but more glutinous than on the previous day. The animal appeared to be dying of asphyxia, a short time after the photograph was taken, and, seeing no chance of recovery, I ordered the poor creature to be destroyed. The whole duration of the case, therefore, it will be seen, was not much more than twenty-six hours. A post-mortem examination was made, and all the usual signs of death from this dreadful scourge revealed themselves. The lungs were in this case most intensely congested. I need not repeat the lesions found in this disease, as I have already had occasion to do so in my previous publications.

'Compared with the other cases I have recently described in the pages of the *Veterinary Journal*, this one under our immediate notice did not manifest so much the "angina," so very characteristic in the other two; yet it was of an even more virulent and deadly type.

'There is one more point I should like to mention, and it is this, that glossanthrax in horses is not referred to in the anthrax order recently issued by her Majesty's most honourable Privy Council, and that it is most especially very sincerely to be regretted that anthrax fever in horses is not included in the scope of the Act.'

Anthracoid Angina.—This is a disease rarely occurring unassociated with glossanthrax. It consists in infiltration of the glands and connective-tissue in the region of the throat, the swelling being hot and painful. The swelling proceeds rapidly, involving the structures of the head, and soon the glottis and pharynx become œdematous. Thus the breathing becomes difficult, and death results from asphyxia.

There is often a sanguineous discharge from the nose, accompanying the swelling around the throat and larynx.

THE LOODIANAH DISEASE.

This disease is the form of anthrax commonly seen in India, the name being derived from the fact that the malady assumes a very severe form in Loodianah, in India.

It is especially seen in low damp situations where the sanitary conditions are defective.

The symptoms differ very little from the anthrax fever occurring in Europe. The temperature may in some cases reach as high as 108° or 109° F.

The percentage of recoveries is small.

THE CAPE HORSE-SICKNESS.

or Paard-Zietke, is another form of anthrax which affects horses in the Cape of Good Hope and other parts of Southern Africa.

Immunity from Anthrax.—One attack does not secure immunity from a second.

Morbid Anatomy of Anthrax.—Animals which die of anthrax are especially prone to decompose rapidly.

The subcutaneous connective-tissue is found distended with a yellowish serosity and gas. The skin itself is stained.

The intestinal mucous membrane is softened, deeper in colour, and studded with rounded infiltrations. Peyer's patches are enlarged; the peritoneum presents blood extravasations, and the folds often contain a yellowish exudation. The mesenteric glands are swollen and infiltrated, and the veins all over the body contain dark blood.

The pleuræ are ecchymosed and stained, and the pericardium and endocardium are similarly affected. The walls of the heart are weak and flabby, and the pericardial sac contains fluid. The lungs may or may not be congested, and there is frothy mucus in the air-tubes, and the lining membrane is infiltrated. The spleen is enlarged, sometimes being treble the ordinary size, and is friable and full of black tarry-looking blood. The liver is abnormally friable. The pelvis of the kidney and the lining of the bladder are ecchymosed.

The brain is congested, and its membranes also. There is also effusion into the subarachnoid space. The spinal cord and its membranes are similarly affected. There is infiltration of the yellowish exudation into the retro-pharyngeal and laryngeal tissues.

In anthrax attended by local manifestations, we shall find carbuncular elevations, above described, and large, deep, yellow ulcerated cavities.

Blood.—There is decrease in the elements of fibrine; the white cells are increased in number; the red cells cohere in masses, and are shrunken.

Bacilli may be observed under the microscope as cylindrical rods 5-20 μ in length, and about 1 μ in breadth, straight, with slightly concave ends and motionless. The rods elongate into filaments which divide by fusion. Spores develop at 30° to 35° C., and give a beaded appearance.

If the temperature is lower than this, spores are not developed, nor are they formed if the temperature is above 40° to 47° C.

There is no development without oxygen.

(For further particulars of the Bacillus Anthracis, *vide* Chap. III.)

The post-mortem appearances of anthrax will vary much with the symptoms shown during life; and in cases of artificial inoculation bacilli will be found at the seat of the lesion.

Morbid Anatomy of Glossanthrax. — Pathological changes are especially found about the larynx and tongue, and consist in extensive infiltration of yellowish exudate and extravasation of blood in that vicinity. The tongue is swollen and of a dark purplish hue, and presents vesicles and sores left by the bursting of some of them.

The salivary and lymphatic glands are enlarged and infiltrated, and the glottis is œdematous.

Treatment of Anthrax.—Give a mild laxative, *e.g.*, aloes or salines, and also some antiseptic remedy, as carbolic acid, sulphite of sodium, or sulpho-carbolate of sodium.

If carbolic acid be selected, 30 minims may be dissolved in a pint of water, and given thrice daily. If sulphite of sodium be selected, it may be administered in large doses thrice daily in the acute stages of the disease.

Special symptoms, such as abdominal pain, will require special treatment in addition.

Mineral acids may also be given. Chlorine and other inhalations have been recommended. If there be much debility, alcohol may be administered, and tonics should be given in convalescence. The food should be as nourishing as possible, and should be given in a liquid form. If the animal is unable to swallow, it will be necessary to give it in the form of an enema.

Tumours, when formed, should be incised, and either cauterized or dressed with antiseptics.

Treatment of Glossanthrax.—If the vesicles appear on the tongue, they should be opened and dressed with carbolic acid solution. The internal treatment is the same as above recommended for anthrax.

If the tongue is much swollen, we may scarify deeply, and treat with a solution of carbolic acid (2 per cent. solution).

Hot-water vapour when inhaled is of benefit. It may be medicated with advantage. The swellings should be fomented with hot water. In some cases where the swelling is producing suffocation, tracheotomy is necessary.

Prophylactic Measures in Anthrax.—Carefully examine into the food and water supply, and take special care that there be no escape of effete matter into the wells or ponds.

Ascertain if the food be mouldy or fermenting, as mouldy grains have been asserted to cause anthrax in some instances. (*Vide Veterinarian* April, 1878.)

The healthy animals should be isolated from the affected ones; and the stables in which the horse contracted the disease or died, and all implements, such as harness fittings, etc., should be thoroughly disinfected and cleansed. The carcases should be interred deeply, and the litter and manure should be burned (Fleming).[1]

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[1] In an article in the *Veterinary Journal* of January, 1884, we have recorded a large number of cases of anthrax fever in horses and beasts treated by the administration of sulphite of sodium. We believe it to be of the greatest value in this disease, and of more potency than any other antiseptic, and we also believe it to be in a measure preventive. The late Mr. D. Gresswell, F.R.C.V.S., used this remedy in all cases of anthrax in the horse and beast coming under his care.

In the *British Medical Journal* of June 14, 1884, Mr. Baker, F.R.C.S., Surgeon to St. Bartholemew's Hospital, records a case of 'Malignant Pustule' in man treated by excision and the administration of sodium sulphite. The disease was contracted from handling infected bales of wool from China. The case terminated in complete recovery. Mr. Baker adds that he was induced to select this drug from a perusal of the cases recorded by us in the *Veterinary Journal* and the success attending its use.

PYÆMIA AND SEPTICÆMIA.

'These diseases result from the absorption and dissemination of substances derived usually from septic disease of some wound or inflammation' (Green).

By *septicæmia* we understand a form of septic disease unaccompanied by the development of secondary inflammations.

By *pyæmia* is meant a septic disease characterized by the presence of secondary or metastatic suppuration.

Nature, Pathology and Morbid Anatomy of Septicæmia and Pyæmia.—Koch has shown that by injecting five minims of blood or meat, in an early stage of putrefaction, under the skin of a house-mouse, the animal at once becomes restless, and its movements weak and uncertain.

The respirations become slower and irregular, and death occurs in about four to eight hours. No pathological lesions are found, and the blood taken from the animal and inoculated into others has no effect. The disease is therefore non-infective, and as it follows the absorption of putrid matter into the blood, and is not accompanied by secondary inflammation, it is therefore a septicæmia.

The effect of the poison is comparable with the results of the injection of a poisonous alkaloid. This form of septicæmia is termed 'septic intoxication.'

Sanderson gives the following as signs of septic intoxication in animals:

'Restlessness, muscular twitching, and increasing weakness; profuse diarrhœa, the fæces being loose, whitish-grey, and later bloody. The temperature rises at first, but often falls before death. Respiration and heart's action gradually fail, and death may be preceded by cramps.

'The post mortem changes found are :

'Blood dark; petechiæ beneath the pericardium, endocardium, and pleuræ. Intense staining of endocardium and lining of the large vessels, and often a little blood-tinged serum in the serous cavities, both soon after death, indicating destruction of red corpuscles even during life ; intense congestion and ecchymosis, with shedding of the epithelium of the mucous membrane of the stomach and intestines ; spleen swollen, soft and pulpy ; liver often swollen and congested' (Green).

If now house-mice be inoculated with less quantity of poison, the effect on the system will also be lessened. If a drop or two only of the blood or meat infusion be injected under the skin, many of the animals will show no untoward symptom, while about a third of them will gradually sicken and die. The symptoms thus manifested are : Dulness of the eyes ; slow respiration ; great weakness and prostration ; and death occurs gradually in forty to sixty hours after inoculation. After death there is slight œdema, sometimes absent, at the place of inoculation, and the spleen is much enlarged.

Now, again, if a house-mouse be inoculated with a *most minute portion* of the blood from one of the animals just dead, the disease will be produced in it, and death will ensue in less than two days.

Now, this disease thus engendered is a septicæmia. But it differs from the first-mentioned form of disease in being *intensely infective.*

The poison introduced gives rise to the disease by multiplying in the blood, and not by reason of its toxic properties, for it is in too small amount.

A period also elapses between the time of inoculation—

the period of incubation—and the manifestation of symptoms, during which the germs multiply. This period may be about twenty-four hours.

This form of septicæmia is termed septic infection.

The blood of animals which had died after injection of one to ten minims of putrid blood contained bacteria, cocci, and bacilli; but after inoculation it contained only bacilli' (Green).

There are thus two forms of pathological conditions under the heading Septicæmia, viz., Septic Intoxication and Septic Infection.

The former is due to absorption of chemical poison, manufactured in some putrefactive process going on external to the body. The latter is due to entry of specific germs into the blood, and to their multiplication there. The organisms in these cases probably act by producing poisonous substances in their growth, but these products are not irritant, and therefore secondary inflammations do not ensue. Fungi which occur in the septicæmia of one animal differ from those which occur in another.

A six-year-old dark-brown cart-horse, which belonged to one of the chief farmers near Louth, in Lincolnshire, suffered from a serous abscess on the elbow-joint. The capped elbow was lanced by the foreman. Within a little less than twenty-four hours the horse was seen to stagger and reel to and fro. The horse was placed in a loose-box, when he rapidly became insensible. About six hours before death, Mr. J. B. Gresswell, having been called in, saw the animal. The horse was in a comatose state, and was breathing stertorously, and the pulse was slow, as is usual in such cases, and numbered about 20. The wound and all the surrounding part was found to be very fœtid, and almost gangrenous, and soon afterwards the animal died.

After death the skull was opened, and the brain was found to be very hyperæmic, and soft in parts.

Another case which occurred was somewhat as follows: A person had cut open a serous abscess in the shoulder of a seven year-old black cart-mare. This cut was made in the morning, and the same observer saw the animal on the evening of the next day. Symptoms of disorder of the brain had rapidly been developing, and the animal was already semi-comatose. Death occurred on the morning of the third day. A post-mortem examination revealed that there was a collection of creamy matter in the brain.

In many cases where septicæmia follows upon some local lesion, death quickly ensues from pulmonary embolism. In one case of a large wound in a four-year-old brown blood gelding, about twelve hours after the lesion was formed (by the horse galloping straight through a five-barred gate, which was smashed, so to say, to atoms), the symptoms began to take on the form of acute pulmonary embolism. The pulse was 96, the temperature was 105°, the respirations both difficult and rapid. This horse died about twelve hours after the appearance of acute symptoms, and twenty-four hours after receipt of the injury. Death was certainly not due to loss of blood, but to septicæmia. After death an examination revealed excessive congestion, and patches of decomposition in the lung-tissue. In the horse this quick decomposition of the lung-tissue is not unfrequently seen.

Cases of septicæmia sometimes occur in consequence of the use of an unclean knife by a castrator. Two fatal cases came under our notice, both castrated by the same man with the same instrument, and both animals died within twenty-four hours with symptoms of acute *septic peritonitis.* Cutting abscesses and so forth with unclean knives may, of course. be coupled with the same bad results.

In pyæmia, the absorption and dissemination of the poison gives rise not only to the general disease, but also causes the formation of secondary foci of inflammation, which are termed metastatic abscesses.

The clinical symptoms of pyæmia are well marked; the irregularity of the temperature being the most prominent feature. Pyæmia is complicated with more or less septic poisoning. The source of the infection in pyæmia is almost always a wound or inflammation, generally suppurating, the discharge being septic. In some cases, however, no wound is traceable. As in septicæmia, the poison gains access to the blood-current, which distributes it through the system.

The secondary abscesses of pyæmia are of two kinds; those which are preceded by infarction, and those in which we have no evidence of this antecedent occurrence.

The suppuration is probably due to the parasitic fungi irritating the tissues in which they are placed. In the former kind of abscess the infarction is due to the lodgment of an infective clot in a terminal artery. The most frequent seats of these embolic abscesses, as they are termed, are the lungs especially, the liver, spleen, kidney, and brain, but they may occur in any vascular part of the system.

They vary in size, and are usually multiple, and may be very numerous.

The other kind of abscesses are diffuse suppurative inflammations in the subcutaneous and connective tissues, in the joints, and in the serous membranes. They are fairly often met with, and may or may not coexist with the embolic abscesses above mentioned.

Besides the secondary abscesses, there are other lesions found on post-mortem examination. The wound, if present, is in a sloughing condition, perhaps surrounded by diffuse infiltration of the tissues, and is offensive. There are extensive thrombi in the veins leading from the point of infection; these thrombi are undergoing infective puriform softening.

The blood is darker than in the natural condition, and not disposed to coagulate, and contains *excess of white blood-cells.* Congestion of the lungs is generally present; the spleen is large and pulpy; the liver and kidneys show granular degeneration.

Etiology of Pyæmia in the Horse.—Pyæmia is chiefly developed in connection with injuries and wounds, and more especially in connection with suppurative-action in bone.

It may accompany various diseases, notably the specific fevers.

Symptoms of Pyæmia in the Horse.—Rigors and localized perspirations. Sudden elevation of temperature, which rises and falls irregularly. It may rise to 106° or more, and, though variable, is always high.

Pneumonic symptoms are often developed from the formation of abscesses in the lungs. Also other special symptoms, due to the formation of abscesses in particular organs, are frequently manifested. The skin may be jaundiced, and show petechial markings. In cases following wounds, the latter, a few days after infliction, show abnormal changes.

Infiltration, leading to œdema and gangrene of the surrounding connective-tissue, comes on, and the wound discharges an unhealthy ichorous matter, and gases accumulate in the subcutaneous tissue. When pyæmia accompanies the specific fevers, it usually first shows symptoms after the acme of the fever has been passed.

Prognosis of Pyæmia.—This disease is generally fatal.

Treatment.—Allow plenty of fresh air, and a liberal and nourishing diet.

The drugs which are specially recommended are—quinine, arsenic, salicine and salicylate of sodium, and iron. Alcoholic stimulants are, no doubt, of great value in the treatment of pyæmia.

Carbolic acid has also been recommended in moderate doses. If there be any wound, it should be carefully attended to, and well dressed with antiseptic lotions.

SURRA.

Surra is a disease widely spread in India. The name 'surra' signifies 'rotten,' and the disease is so termed from the great emaciation occurring in animals affected with it. Our knowledge of this malady is due to the members of the profession residing in India—especially to Mr. Griffith Evans, of the Army Veterinary Department.

Definition.—Surra is an enzoötic disease, due to the presence of a special animal parasite in the blood, and characterized by progressive emaciation, dropsical swellings, elevated temperature, and extravasation into the visible mucous membranes.

Symptoms.—The symptoms are somewhat variable. Fever is present; there is a yellowish discharge from the nose, and sometimes the submaxillary glands are enlarged, and may discharge.

The visible mucous membranes are yellow, and present petechiæ which are especially seen on the inner canthus of the eye, and in the female in the vagina. The appetite is generally good. The urine contains albumen, and is highly coloured; and there is gradual progressive emaciation and marked thirst.

Sometimes in the early stages there is loss of motor power in the limbs. Dropsical swellings are sometimes seen in the mare between the fore-legs, and in the horse in the sheath.

Etiology.—The disease is due to the presence of an animal parasite in the blood. It is capable of being propagated by subcutaneous or intravenous injection, or by introduction into the alimentary tract of blood infected with parasites. It is not known how the disease is spread, but probably the parasite gains access into the system through the drinking-water.

Prognosis.—Death usually occurs in seven to ten weeks, at the end of which time the animal may expire suddenly, or may become delirious and death ensue more slowly.

Morbid Anatomy.—The intestinal membrane is yellow, and shows small extravasations.

The peritoneal and pericardial sacs contain lymph.

If fresh blood be examined under the microscope, the parasites may be seen in groups or singly.

They have an oval-shaped body, separated from a spheroidal head by a neck, and the tail tapers into a long flagellum.

In the cervical and in the caudal region there is a papilla-like eminence.

The length of the parasites is about three or four times that of a white blood-cell. They are whitish in colour, and appear in the field to attach themselves to the red corpuscles. The white corpuscles are increased in number.

Treatment.—Turpentine, carbolic acid, and other antiseptics are worthy of trial.

MALADIE DU COIT.

Synonyms.—Syphilis du chéval; epizoötic paralysis; contagious eczema; vérole.

Definition.—Is a specific contagious disease, characterized in the early stages by morbid lesions in the urino-genital apparatus.

Varieties.—Benign and Malignant.

Geographical Distribution. — The disease was seen in Russia in 1796. Since then it has occurred in parts of Africa, Egypt, and most European countries. There is no record of its occurrence in Spain, Belgium, and Great Britain.

Etiology.—The origin of the disease is obscure. It has not been proved to have any relationship with syphilis.

Symptoms of the Benign Form.—In the female this disease appears in one to fourteen days after copulation. The first symptoms are often so slight as not to attract attention. The symptoms are the same as those shown in œstrum; but in this disease the sexual desire is insatiable. The vaginal mucous membrane is red, and discharges a muco-purulent fluid, which, slight at first, becomes thick and viscid and coagulates on the adjacent parts. Pustules about the size of millet seeds appear in the vagina and fossa navicularis. The pustules become ulcers, which rapidly heal and are replaced by others. There is œdema of the abdomen and extremities, and some engorgement of the submaxillary glands.

The symptoms gradually disappear in two weeks to two months.

In the stallion, beyond swelling of the sheath, this form of the maladie du coït is unnoticeable.

The benign may pass into the malignant form in either sex.

Symptoms of the Malignant Form.—In the mare the symptoms begin in the same way as in the benign form, but soon become more pronounced.

The lips of the vulva alternately swell and diminish in size. The anus, mammary gland, and perinæum are swollen; the vaginal mucous membrane presents furrows, becomes more infiltrated, and presents blue and yellow patches, and pustules are formed on its surface. The discharge from the vagina is excoriating. Lenticular pustules may appear on the external surface of the lips of the vulva, on the perinæum, and inside the thighs. Scabs form over them and leave circular ulcers, which heal rapidly. The clitoris is swollen, and the discharge becomes reddish green and fetid. Urine is ejected frequently and in small quantities, and causes much irritation when passed.

Mares in foal usually abort at the third month, and if the foal is born it is dead or soon dies.

In the stallion the symptoms are very uncertain; the disease may remain latent for a very long time. The sheath is œdematous, and the swelling may extend in front and behind it. The testicles may or may not become swollen. The penis also may or may not be altered; sometimes purple spots are found, and the glans during erection may be very large. The urethral mucous membrane projects in a globular form from the meatus, and is crimson or yellow. Urine is passed in a small jet, and with much pain.

Paraphymosis, the result of local swelling, is not uncommonly met with.

General Symptoms, common to both Sexes.—There is a muco-purulent discharge from the nose, and also a discharge of tears from the eyes. The visible mucous membranes are highly injected. The coat is dry, and the perspiration, when breaking out, is offensive. Pressure over the lumbar region causes pain, and the animal rests first on one hind-limb and then on the other. The lymphatic glands in the neighbourhood of the genital organs are engorged, and those in the submaxillary space are similarly affected. The animal is much debilitated, and walks with uncertain gait; the large joints are tumefied and painful; the haunch especially is affected. The pain causes the animal to lift its leg while at rest, with a sudden jerk.

The appetite is generally pretty good. Often one or both hind extremities becomes paralyzed, and the entire muscular system becomes atrophied, especially the hind-quarters and legs.

The nasal membrane becomes yellow, and the buccal membrane of purplish hue.

The mammary gland may inflame and suppurate. During the incubatory stage of this disease numerous cutaneous tumours form on different parts of the skin. They are small, of medium size, or large; the small ones appear and disappear suddenly; the larger ones develop in twenty-four hours, and disappear in from four to eight days.

Albumen is present in the urine.

Prognosis.—The disease usually lasts three or four months, but may extend over a period of three years.

Contagion.—The disease is readily transmissible by copulation. Mares take the disease more readily than stallions.

Morbid Anatomy.—The external lesions are always present. The sheath is infiltrated with serous exudation, giving it a yellowish, hard, homogeneous appearance when cut into. The penis, especially the glans, is also infiltrated, and the mucous membrane of the vesiculæ seminales is red or violet coloured, and contains a purulent matter.

The testicles are sometimes enlarged, and contain yellow serous fluid; they may be atrophied. The uterus contains yellow or brown coloured muco-purulent matter; the kidneys are sometimes normal, but sometimes enlarged, and contain a white albuminous substance. The membrane of the bladder is thickened, ecchymosed, and of a reddish brown colour. The muscles and bones are friable; the coxo-pubic and femoral ligaments are red, thickened, softened, and may be ruptured.

The synovial fluid of the joints is abundant, cloudy, and dark-coloured. The cartilages are soft and yellow. The sub-glossal, sub-lumbar, mesenteric glands, and those near the genitals are enlarged, yellow or reddish, and often contain pus. The spinal cord, especially in the lumbar region, is sometimes softened. The sub-arachnoid fluid of the brain is increased, and according to some the brain itself is in a degenerate condition.

The sacro-sciatic nerves and lumbar plexus are infiltrated with serum.

The sinuses of the head often contain a yellow oily matter. The blood is much altered, and is fluid and deficient in fibrin.

Treatment.—M. Trelut gives fibrin, ʒxv., as an electuary, or in gruel as a drench, in the morning; also, turpentine, ʒv.—vii. ss., every second morning with the drench.

From ʒi.—ii. ss. of reduced iron, alternated with gr. xv.—xxx. of white arsenic, is given in addition. Food of the most nutritious kind is allowed. M. Trelut afterwards substituted cooked horse-flesh for the fibrin. When paralysis set in, cantharidine liniments, followed by mustard poultices, were applied to the abdomen, and, when there was effusion, the pointed firing-iron was applied, penetrating as deeply as possible.

The treatment is continued two or three months.

Local Treatment.—In stallions, when the disease is confined to the genital organs, castration has been performed.

In the mare, emollient injections, followed by astringents, have been recommended.

PURPURA HÆMORRHAGICA.

Definition.—Is an eruptive, non-contagious, intermittent fever, characterized by the presence of petechiæ on the mucous membrane, and by elevations of the cutaneous tissue.

Pathology and Etiology.—Purpura usually occurs as a sequel to debilitating diseases, viz., influenza, catarrhal fever, and strangles; its origin being usually traceable to bad ventilation.

It may also, though rarely, occur as a primary disease, as a result of malhygienic conditions, *e.g.*, defective ventilation, bad drainage, and poisonous effluvia.

Purpura is due to an abnormal condition of the blood and blood-vessels, resulting from the above deleterious influences.

Symptoms.—Purpura may follow the defervescence of mild as well as of severe attacks of such diseases as strangles, catarrh, and influenza. Usually the first noticeable symptom is the sudden development of local swellings on different parts of the body; on the limbs, abdomen, head, and especially around the nostrils, mouth, and lower part of the face. They sometimes appear in patches; but when on the limbs, they are often more uniformly diffused. They terminate abruptly, not shading insensibly away into the surrounding tissues; they are tense, invariably elevated above the level of the skin, pit slightly on pressure, and are hot and painful. The swellings are due to transudation of blood and serum into the subcutaneous tissue.

Vesicles, or bullæ, of about the size of a pea, appear upon the lower parts of the limbs, around the hock and fetlock joints, and after a time burst and discharge an amber-coloured serous fluid, which scalds and excoriates the surface of the skin over which it flows.

Cracks and fissures also appear at the flexures of the limbs, and from them issues an unhealthy dark-coloured discharge.

The swellings about the sheath, abdomen, and breast often disappear from one part in the earlier stages of the disease, and reappear again in another region.

In many cases the face, lips, nostrils, and eyelids become very much swollen; the swelling ending abruptly about the forehead.

Death may result from swelling of the head owing to interference with respiration, the swollen nostrils causing great difficulty in breathing. The animal, also, is prevented from feeding, owing to the swelling interfering with the movements of the tongue and jaws.

The skin of the swollen parts often sloughs, and large unhealthy sores discharging fetid matter are formed. The lining membrane of the nose becomes more deeply coloured and studded with petechiæ, which gradually coalesce and become darker in colour. Eventually, the greater portion of the mucous membrane of the septum becomes covered over, and there is a discharge of a sero-sanguineous fluid from the nose.

Similar blood extravasations probably simultaneously involve other mucous membranes and the skin in various parts of the body. The skin being pigmented, the purplish petechial spots are not often seen except in parts where it is not coloured.

The pulse is feeble, often dicrotous and accelerated. There is great debility and prostration. The temperature generally rises 3° or 4° F.

The bowels are at first confined in most instances, but purgation is easily induced. The fæces may be blood-stained, and abdominal pain is frequently present. There is impaired appetite through the course of the disease, and a hoarse hollow cough is often present.

The petechial spots in the nose frequently slough and leave raw surfaces, from which issues the dark-brown sero-sanguineous discharge above mentioned. The tongue is sometimes found swollen, with vesicles on the surface.

The animal moves with difficulty, owing to the stiff and painful state of the joints.

In many cases enteric complications are very severe, and in every case sudden extravasations into the mucous membrane of the alimentary tract may cause death rapidly from excess of the internal hæmorrhage. Similarly, extravasations may occur in connection with other internal structures, and, if extensive, may cause sudden and fatal collapse.

Extreme cases of purpura we have known to last for six or seven weeks. The swellings, especially those on the thigh and near the sheath, display a remarkable tendency to slough. A well-known dealer in cart-horses once had a six-year-old cart-horse affected with the most acute form of purpura which it has ever been our lot to witness. In this case the symptoms appeared quite suddenly. Even during the course of one single night, all four limbs became enormously swollen. The temperature was 104·2° F., and the pulse numbered 86; the respirations were 37 per minute. A large purple petechial spot made its appearance on the outside white of the nostril. This spot was as large as a shilling, and several smaller spots also made their appearance. On the second day the swellings left the hocks and knees, while the inside of the thighs and the head became enormously swollen. There was also a serous discharge from the nose. On the tenth and eleventh days the sheath and also the region around the anus also swelled. On the fifteenth and sixteenth days the swellings separated by means of local gangrene, and eventually the animal made a perfect and complete recovery.

It is very important to note that purpura hæmorrhagica greatly resembles anthrax in general appearance, though it may be easily distinguished from that disease by the presence of the purple markings which are seen on the skin and mucous membranes, and also by the more chronic and slower course of the malady. The head is enormously swollen in cases of purpura, just as it is also swollen in the case of animals suffering from anthrax. In the case of animals afflicted with glossanthrax and many other forms of anthrax the breath is most offensively fœtid, but it is not even offensive in animals suffering from acute attacks of purpura hæmorrhagica.

Prognosis.—Is difficult, owing to the fact that cases in which the early symptoms would lead us to expect a favourable issue may at length terminate fatally.

Morbid Anatomy.—The blood is non-coagulable and of dark violet tint; the red cells are altered, and the white cells are increased in number.

The cutaneous swellings and subcutaneous tissues of the swollen parts are infiltrated with dark red, feebly coagulable exudation.

Dark spots are found on the thecæ of the muscles, and in the muscular tissue in various parts.

The serous membranes show petechial spots and extravasations. The pleura, endocardium, pericardium, and cerebral and spinal meninges, may all be so affected. The serous cavities themselves often contain a gelatinous coloured exudation. The mucous membranes are black or blackish-green. The intestinal membranes frequently present ecchymosis, and much infiltration with exudation. The mesenteric glands are similarly infiltrated; the liver and spleen are congested and friable. The lungs are also usually congested, and the trachea and bronchi filled with dark-coloured frothy extravasation.

Treatment.—Attend to the sanitary conditions firstly and chiefly. Medicinally, chlorate of potassium and salines, followed by iron preparations and doses of turpentine, may be administered.

Astringents are preferred by some, ergot of rye, tannin, and tincture of perchloride of iron being especially recommended.

Antiseptics also are worthy of trial, and the beneficial action of chlorate of potassium may be due to its antiseptic effect.

If there be much debility, alcohol and vegetable tonics should be given. We have found calcium sulphide, in full doses, of very great value in the treatment of this disease.

Ammonium salts are to be avoided.

The diet should be liberal.

Locally, the sores should be dressed with antiseptic solutions. If the head be much swollen, fomentation with warm water is very useful. The swellings should not be punctured.

If there is much dyspnœa from swelling of the mouth or nostrils, tracheotomy may be necessary; but very seldom indeed is it necessary to perform this serious operation.

SCARLATINA—SCARLET FEVER.

Definition.—A febrile disease, generally accompanying or occurring as a sequel to some other general and debilitating disorder, and characterized by the eruption of vesicles on certain parts of the skin, and by petechial spots on the mucous membrane of the nose and mouth, together with sore throat and swollen cervical glands.

Varieties.—Scarlatina Simplex, and Scarlatina Anginosa.

Pathology and Etiology.—Scarlatina in the horse has not very much analogy with the disease of the same name in man.

In the horse it rarely occurs as a primary disease, but nearly always is an accompaniment or sequel of some other debilitating disease, such as influenza or strangles. It usually appears as the fever of the primary affection is declining.

Scarlatina, like purpura hæmorrhagica, is traceable to malhygienic conditions and weakened constitution associated with the primary malady. It is probably non-contagious, and is more prevalent in spring-time than at other seasons of the year.

Symptoms of Scarlatina Simplex.—Usually begins towards the end of the first week of the primary malady. It may begin on the third, fourth, fifth, or sixth day, or even later. The febrile symptoms become more severe, and there is great prostration, as well as a slightly swollen condition of the eyelids. The temperature is usually elevated about two degrees, and the rise precedes the appearance of the rash.

The 'rash' or 'eruption' of scarlatina take different forms, of which two at least are distinguishable in the horse.

Firstly, there are developed upon the skin of the face, neck, body, and extremities, smooth blotches, over which the hair is elevated, though the skin itself is little or not at all elevated.

The second form of rash consists in the eruption in various parts of the body, especially on the inner aspect of the thighs, of small rounded vesicles, which eventually desiccate.

The nasal mucous membrane and the membrane of the mouth are covered with scarlet spots, or petechiæ, of variable size. These spots are especially seen on the nasal septum, and on the inner surface of the lips. From the nose there is a serous discharge which gradually becomes yellowish-brown in colour.

The limbs are generally swollen, and the animal is stiff. In some cases of scarlatina there is no eruption, and minute spots on the Schneiderian membrane are all we have to guide us in the diagnosis.

Soreness of the throat is present in most cases.

The affection which is called scarlet fever in the horse is possibly totally different from human scarlet fever. The disease, when occurring in horses, may assume a very mild form indeed, and be even so inconspicuous that it seems scarcely sufficient to impair the health of the animals in any material degree. Bright scarlet spots may appear inside the mouth, and may especially be seen on the buccal mucous membrane lining the inside of the cheeks. Nine animals on one farm were affected with this disease, and every one of them rapidly recovered. It seems doubtful if the name 'scarlet fever' is correctly assigned to this malady, and also to what extent this disease is allied to the scarlet fever of human beings.

Symptoms of Scarlatina Anginosa.—Scarlatina anginosa is a severe form of the disease, in which the throat and upper air-passages are especially involved. The symptoms may at first be those of the simple form, and then gradually increase in severity; or the fever may assume a severe form at the outset. In this form the limbs swell rapidly.

The swellings are hot and painful, and may also appear on the face and head.

The rash and vesicular eruption are more frequently found on the limbs than the body, and appear as in the simple form, in successive crops, or spread by the coalescence of neighbouring patches. The petechial spots of the nose and mouth are larger and darker in colour, and more likely to coalesce than in the simpler form of scarlatina. There is great difficulty in breathing and swallowing, and there is a loud and painful cough.

The tissues, glands, and other structures in the neighbourhood of the throat and larynx are swollen, infiltrated, and painful. In some protracted cases the bronchial or submaxillary glands may suppurate.

The parts of the skin where the eruption is present are not distinctly elevated, and in this particular they differ from the localised swellings of purpura hæmorrhagica.

The pulse is rapid, varying from 60 or 70 in mild cases, to 100 or more in severer attacks ; it is weak, of small volume, and frequently dicrotous, especially in the later stages.

The respirations are accelerated, especially when the lungs are congested.

Œdematous swellings may suddenly appear on the inferior parts of the abdomen and chest, but they are not of constant occurrence. There is a discharge of serous fluid from the nose, which often becomes yellowish-brown, and in rare cases sanguineous.

The bowels are usually confined.

The fever, when uncomplicated, generally declines in six to eight days ; not suddenly, but by oscillations.

During the rash and infiltration of the structures around the throat the fever shows no abatement.

After the fever, and decline of the rash, there is shedding of the hair where exudation from the vesicles has occurred, and desquamation of the epidermis over the body. Great debility often remains after active symptoms have disappeared, and there is great weakness of the heart, and tendency to effusion into the pleuræ and pericardial sac.

Scarlatina is sometimes followed by inflammation of a rheumatic character.

Prognosis.—Is very uncertain. If the swelling in the throat increases, and the breathing becomes difficult from implication of the upper air-passages, or congestion of the lungs, the prognosis is very grave.

Morbid Anatomy.—The blood is darker, and is not so coagulable as in the healthy condition. The membranes most marked by petechial extravasations are those of the nose and mouth, and those of the heart and abdomen.

The connective tissue in many parts of the body has a reddish or rusty tinge.

The mucous and submucous tissue of the throat, as well as the glands in the neighbourhood, are swollen and infiltrated with exudation.

Diagnosis.—Scarlatina may be confounded with purpura hæmorrhagica, erysipelas, and eczema.

The petechiæ in scarlatina are minute spots which may form patches by coalescing together, and they are scarlet in colour. In purpura they are of a dark purple hue. Sore throat is never absent in scarlatina, and but rarely present (unless it be a symptom of previous disease) in purpura.

'Also in scarlatina the swellings are at first in the form of lumps, whereas in purpura they show an even surface, occupying the face as a whole, or the limbs, and terminate abruptly above, as if a cord had been tightly drawn around the part' (Williams).

In scarlatina there is often swelling, and sometimes suppuration of the glands (submaxillary and bronchial glands especially); whereas in purpura this does not occur. Again, the disposition to sloughing of various parts of the body is characteristic of purpura.

Treatment.—Place the animal in a warm well-ventilated loose box. The food should be laxative and nutritious, and doses of nitrate or chlorate of potassium, or sulphite of sodium, may be administered in the drinking-water. This treatment will suffice for mild cases.

In the more severe forms, the throat should be fomented with warm water, and hot poultices should be applied and renewed frequently. Hot-water vapour, medicated by the addition of carbolic acid, should be used for inhalation.

When the breathing is very difficult, and accompanied by a loud roaring noise, tracheotomy is in some cases necessary in order to avert suffocation. Liquor ammoniæ acetatis, nitric ether, and camphor, may be administered three times daily, in the form of a drench, and a gentle laxative may be given if necessary. If the throat be much swollen and deglutition be very difficult, the remedies mentioned should be given in the form of enemas.

As the pyrexial symptoms abate, quinine and other vegetable tonics and sulphate of iron may advantageously be given twice or three times daily.

When suppuration is detected, the abscess should be opened. The external swellings on the limbs should not be interfered with.

During convalescence, careful attention should be paid to the dieting. The food should be of the most nutritious kind, but in moderate quantity at first, until the digestive organs regain vigour. Moderate exercise should be enjoined as the animal regains strength.

RABIES.

Definition.—Rabies is an infective febrile disease, originating in the canine and less frequently in the feline race, and occurring in the horse as the result of a bite of some rabid animal. The specific virus is transmitted through the saliva of the rabid creature; and the disease is characterized by pain in the part bitten, great excitement, irritability, a disposition to bite, clonic spasms, prostration, and death.

Etiology.—Rabies is said by many to arise spontaneously in canine and feline animals, but this is doubtful. It usually occurs in the horse as the result of the bite of a dog. Whether it can be transmitted from an infected horse to a healthy one by biting is uncertain, but probably it can.

The poison is especially virulent in the saliva. Recently M. Pasteur has inferred the existence of a special vegetable parasite in the blood of rabid animals, and to the presence of this germ and its multiplication in the body he attributes this infective disease.

Incubation.—In the horse, the period of incubation varies from two weeks to forty days.

Symptoms.—Begin with great restlessness, excitability, and distress. In some cases there is first observed a lack of power over some of the voluntary muscles, especially those of the hind extremities, or some amount of tonic contraction in the muscles of the back or neck. The excitability is soon much increased, the animal becomes frantic, and attempts in his fury to destroy everything within his reach. In some instances he bites savagely at the seat of the injury.

The temperature is raised 2° or 3°; the pulse is accelerated, its volume is increased, and the artery is firm and hard; the respirations are accelerated, and the appetite is lost; the animal is acutely sensitive to the slightest stimuli. A flash of light or a sudden noise will bring on a paroxysm of fury.

There are convulsive twitchings of the superficial muscles; difficulty in swallowing; a characteristic hoarse cough; abundant flow of saliva from the mouth; paralysis of the posterior extremities may gradually supervene. The remissions and paroxysms in the horse are not so marked a feature as in the dog. In the horse, the remissions are of much shorter duration, and the fits of violence are more aggravated and prolonged than in the latter animal. As the disease progresses the intervals become still less, until at length the state of fury becomes permanent, and the horse, prostrated, dies in convulsions on the second, third, or fourth day.

Morbid Anatomy.—In most cases there are general congestions and inflammations in connection with nearly every organ and structure of the body. In the abdomen, ecchymoses are found on the serous membranes, the liver and spleen are engorged and abnormally friable, and there are extravasations throughout the alimentary canal; the lungs are congested; the small air-tubes are filled with mucus; the heart shows ecchymoses under the endocardium, and may contain fibrinous clots. There is hyperæmia of the nerve-centres and nerve-trunks, and patchy congestion of the spinal cord and brain, especially at the base and choroid plexus; and there may be effusion into the sub-arachnoid space and ventricles of the cerebrum.

Microscopical examination of the nerve-centres in dogs shows capillary thrombosis and other changes, especially around that portion of the floor of the fourth ventricle occupied by the respiratory centre.

The action of the virus appears at first to involve especially the medulla oblongata and the pneumogastric nerves; thus the difficulty in swallowing and the convulsions of the respiratory muscles are accounted for.

Treatment.—When the disease has set in, treatment is of no avail, and it is advisable to shoot the animal.

Bites by rabid animals should be treated at once. If possible, the tissue around the injury should be excised; if the wound be superficial, the application of caustics will be sufficient; if it be deep, the parts must be first excised, and then cauterized or treated by caustics, such as nitrate of silver, caustic potash, or carbolic acid.

RHEUMATISM.

Varieties.—Acute, Chronic, and Muscular Rheumatism.

ACUTE RHEUMATISM.—**Definition.**—Is a constitutional fever characterized by the special tendency to inflammation of certain structures, viz.: the articulations, the coverings of the tendons and muscles, the pericardium and endocardium. These inflammations have a tendency to disappear from one part and to reappear in another, and are called metastatic.

Nature of the Disease.—Rheumatism is a general disease, the proximate cause of which has been maintained to be a poisonous substance circulating in the blood. This poison is stated to be lactic, or some other acid. No excess, however, of any such acid has yet been detected in the blood.

Etiology.—*Exciting causes* of rheumatism are: exposure to cold and wet, sudden chills, damp and malhygienic conditions. *Predisposing causes:* a constitutional tendency to rheumatism, or 'rheumatic diathesis,' as it is termed.

Symptoms.—The local symptoms may be preceded by febrile disturbance.

There is sudden and severe lameness, with or without swelling of one or more joints, most commonly the stifle and fetlock, less commonly of the hock and knee. On manipulation the affected joints are found to be excessively tender. The joints may be affected in pairs—for example, the two hock joints or the two stifles may be simultaneously involved, and the lameness is thus symmetrical. The temperature is elevated, and may reach as high as 104°-106° F. The pulse is accelerated, firm, and full; the urine is high-coloured, scanty, acid or neutral in reaction, and loaded with hippurates and hippuric acid; the bowels are constipated.

In most acute cases the heart is affected. If the inflammation be slight, the symptoms of cardiac mischief may pass unobserved. If, however, there be much pericardial effusion, and inflammation of the heart-muscle itself, of the endocardium and valvular structures, very severe symptoms show themselves. There will be great tenderness over the region of the heart, and the sounds will be altered in character (*vide* 'Cardiac Diseases'). The pain and swellings of the joints frequently subside in one extremity quite suddenly, and then reappear in another; this 'metastasis,' or changing of the seat of inflammation, is a marked feature of rheumatism.

Sometimes the inflammation of the joints does not abate and suppuration ensues. In these cases the febrile symptoms become more severe and the joint is destroyed.

Complications.—Inflammation of the pericardium and endocardium ought, perhaps, to be regarded as part of the acute rheumatic inflammation as much as the inflammation of the joints themselves.

Morbid Anatomy.—Death in acute rheumatism is mostly due to cardiac disease, and corresponding lesions are found accordingly. The joints and the structures around them will be found in different conditions of pathological change, varying with the intensity of the inflammation and its duration.

Treatment.—A mild aperient should be given in all cases. A small dose of aloes or a saline purgative may be selected, and the bowels should be kept open by regulation of diet or appropriate remedies. The abstraction of blood is not to be recommended. Bicarbonate of potassium should be given in full doses three or four times daily with the spirit of nitric ether. If the temperature be high, salicylate of sodium given three times daily for a day or two in full doses proves very effectual in reducing it. Colchicum, in the form of a tincture or the wine, and liquor ammoniæ acetatis are also useful remedies. Locally, hot fomentations to the joints, and anodyne lotions of opium, aconite or belladonna afford much relief. In the later stages, if the joint affections show little improvement, stimulating liniments may be applied. In some cases, where these are ineffectual, vesication with some preparation of cantharides is of service in subduing the inflammation and the consequent pain and tenderness.

CHRONIC RHEUMATISM may follow acute rheumatism, or may occur as an independent affection.

This form may exhibit no pyrexial symptoms whatever. There is less tendency to metastasis of inflammation or to implication of the cardiac structures than in acute rheumatism.

The inflammation of the joints is of a more persistent character, and more frequently leads to ulceration of the cartilages, eburnation of the bones and the formation of osteophytes than is the case in the acute form. In chronic rheumatism the bones in various parts are subject to various pathological changes. Bony excrescences may form on the spinal column, on the bones of the pelvis, and on the synovial membranes of the joints. The joints may, or may not, be enlarged. Anchylosis of the joints, ulceration of the articular cartilages, and eburnation of the extremities of the bones, may often be met with, and various distortions in different parts may result.

Treatment.—When the disease is chronic from the first, occasional laxatives, bicarbonate of potassium and iodide of potassium, may be administered; tonics also may be given in addition. Locally, stimulating liniments are useful. When the disease occurs as a sequel to the acute form, iodide and bicarbonate of potassium, and quinine and other remedies may be tried. Locally it is sometimes advisable to apply the actual cautery.

MUSCULAR RHEUMATISM.—The muscles and their thecæ are liable to a painful affection, which is due to the same causes as other forms of rheumatic inflammation, wet and cold, damp, fatigue. The muscles most commonly involved in the horse are the lumbar and gluteal muscles, and also those of the neck, chest, and shoulder. Generally there is but little constitutional disturbance, though febrile symptoms may be manifested. Especially is this the case when the large lumbar and gluteal muscles are involved, when the pulse is accelerated. The temperature is elevated, and the animal moves with difficulty. The back is elevated, and the affected muscles are painful and tender.

Treatment.—Internally, the same drugs may be prescribed as in acute articular rheumatism, and, in addition, potassium bromide is a valuable remedy. In the chronic forms tonics are very beneficial. Locally, anodyne and stimulating liniments of camphor, belladonna, opium, aconite, with ammonia and turpentine afford much relief.

SCROFULA AND TUBERCULOSIS.

Tuberculosis.—Is an infective disease, characterized by the formation of small nodular masses, called 'tubercles,' and is due to the presence and multiplication of the Bacillus Tuberculosis in the blood and tissues. The lesions are more or less generally distributed, as in acute general tuberculosis, or they are limited to small areas, as in local tuberculosis. Tubercles are of two kinds, grey and yellow.

Grey, or 'miliary' tubercles, or 'grey granulations,' are greyish semi-translucent rounded bodies, varying from minute points to the size of a pin-head, or larger. Yellow tubercles are later stages of the grey variety. They are generally larger, and may reach the size of a chestnut, or even larger, and they are softer.

Fatty degeneration, commencing in the central portions, is the main cause of the difference between the two.

Scrofula.—Is a constitutional condition, characterized by a great susceptibility of certain tissues to become the seat of chronic inflammation, the products of which have but little tendency to become absorbed, but rather tend to infiltrate and accumulate in the tissues.

They thus interfere with the circulation, and so lead to retrogressive and caseous changes; and as there is but little tendency to the formation of fresh blood-vessels, there is no organization of the new growth. These changes are in a great degree to be attributed to the low condition of vitality of the tissues, and to the peculiar character of the inflammatory products.

Relation of Scrofula to Tubercle.—Owing to the similar microscopical appearances of scrofulous and tuberculous lesions, as well as to the presence of the Bacillus Tuberculosis, in what appear to be simply scrofulous products, these two affections have been regarded as identical, and scrofula has been looked upon as not merely due to inherited or acquired liability to simple chronic inflammations.

Now, although tubercular changes are especially liable to occur in scrofulous patients, and though the bacilli may be found in scrofulous lesions, yet the latter may be regarded merely as simple chronic inflammations, affording a suitable soil for the growth of the germ.

Scrofula and Tuberculosis, though of frequent occurrence in cattle, are not commonly met with among horses. In the localized form, tubercle in the horse is said to occur in the lungs, pleura, and glands of the abdominal cavity; and many cases of well-pronounced arthritic disease in young horses are regarded as decidedly scrofulous in nature by Professor Robertson. This form of arthritic disease is peculiarly an affection of the higher-bred horses, and is due to inherited taint, frequently associated with mal-hygienic conditions and improper management. It is attended with mal-assimilation of food; and in the treatment of this disease special care must be taken to correct the hygienic and dietetic errors. If one of the affected joints be examined, the synovial membrane will be found to be thickened and changed, the joint itself is distended with fluid, and the cartilages and ends of the bones will be found in a condition of retrogressive change.

LYMPHANGITIS.

Synonyms.—'Weed;' inflammatory œdema.

Definition.—A constitutional affection, attended with inflammation, commencing in the lymphatic glands and spreading to the absorbents and blood-vessels of one of the limbs, in most cases a hind one, which becomes swollen and œdematous. In some cases both hind limbs are affected, and, in rare instances, a fore-limb is the seat of the disease. The commonest seat, however, is the left hind-leg.

Nature of the Disease.—'Weed' is to be regarded as a general disturbance of function, especially associated with mal-assimilation and impaired digestion. It is especially a disease of the heavy draught-horses of sluggish lymphatic temperament, and is particularly common among certain kinds of agricultural horses.

An attack renders the animal more subject to a recurrence of the disorder; and in many cases one seizure succeeds another periodically, until the limb assumes a permanently enlarged condition, termed 'elephantiasis.'

Etiology.—Predisposing cause: Lymphatic or sluggish temperament, generally inherited.

Exciting Causes: Foremost among the exciting causes is feeding beyond the requirements of healthy nutrition. Cessation or diminution of work suddenly in well-fed animals is also a common cause, as is seen in the frequent occurrence of this disorder among heavy draught-horses after a Sunday's rest. The disease has in consequence been named the 'Monday-morning disease.'

Sudden or prolonged exposure of horses to cold or damp will in many cases bring on an attack by suddenly disturbing the digestive and assimilative functions; and indeed any sudden change in the work or habits of the animal may bring on an attack.

Lymphangitis may also occur as the result of a *local* inflammation of the lymphatics of the limbs, or other parts of the body, as the result of an injury. In the limbs, an injury to the foot, in shoeing, for example, may result in an attack of the lower portion of the limb. This local form does not commence above in the brachial or inguinal glands, as in the general disorder, but spreads upwards along the lymphatic vessels.

Symptoms.—The local inflammation of the limbs is frequently preceded by a rigor, which may last during some hours; and the severity of the disease is shown as a rule by the intensity and duration of this shivering fit.

There is restlessness and lameness at an early stage; and after the rigor has passed, the hot stage follows. The fever is of the sthenic type, and passes quickly through its various stages. The pulse is raised to 70, 90, or 100 beats per minute, and it is hard, full, and firm. The respirations, though not increased in mild cases, are much accelerated in severe attacks, and sweats bedew the body. The visible mucous membranes are congested; the bowels are constipated; the urine is dark-coloured and of high specific gravity. The temperature is raised 2·5° to 3·5° F.; the appetite is lost, and there is great thirst and restlessness. It is scarcely ever less than 104°, and may often be 105°. The normal temperature of a horse is about a tenth of a degree below 100° F., or perhaps a little lower than that.

The swelling and tenderness are first noticed in the lymphatics of the inguinal or brachial region, and the swelling is œdematous, firmish, and slightly irregular. It feels hot, is very tender, and gradually extends downwards, firstly on the inner side of the thigh, but gradually encircling the whole of the limb. The pain and lameness increase until the crisis of the fever is reached, and then remain stationary for a day or two. In severe cases a serous exudation occurs over the inner surface of the limb, in the course of the vessels, particularly at the flexures of the joints.

The general and local symptoms continue to increase in severity for twenty-four to forty-eight hours, and then, remaining stationary, are followed in a day or two by defervescence of the fever, and gradual absorption of the local extravasations slowly reduces the swelling.

Lymphangitis is very prone to recur, and with each fresh attack there is less chance of complete recovery, for in many cases the connective-tissue of the limb becomes hypertrophied and indurated. This condition becomes permanently established, and the entire bulk of the limb is augmented, the hair is removed in patches, and the skin also becomes hypertrophied and indurated. From the organized fibroid state of the connective-tissue, this condition has been termed ‘Elephantiasis Fibroma,’ or ‘Elephantiasis.’

Sometimes, after the disappearance of the fever of a first or second attack, abscesses may be formed on the inner aspect of the limb. They are generally confined to the subcutaneous connective-tissues.

Prognosis.—The great majority of cases recover completely, but the fibroid condition may be left as a sequel.

Complications.—Are rare; there may be pneumonia or enteric complications.

Morbid Anatomy.—There is general swelling of the whole limb, the œdema being especially marked above. The subcutaneous tissue and fascia are infiltrated with a yellow-coloured lymph, and the tissue itself is hypertrophied and indurated. Similarly the connective tissue among the deeper structures is changed. The lymphatic glands in the affected region are swollen, infiltrated, and hypertrophied. In chronic cases they are firm and indurated; in recent ones they may be soft and broken down, forming small abscesses.

Occasionally the mesenteric glands are enlarged and infiltrated with a gelatinous straw-coloured exudation, and the abdominal cavity may contain a similarly coloured fluid.

In elephantiasis the skin is thickened, and there is organization of the effused matter. The lymphatic glands in these old standing cases may be calcareous.

Treatment.—Bleeding from the jugular vein is generally practised in the early stages. We find that bleeding in the plethoric cases is attended with the very best results. Purgatives should be administered in moderate doses, but excess of purgation is to be avoided. Aloes in doses of two to four drachms may be given, or salines may be used.

Febrifuges are of great benefit in the early stages. A draught of solution of acetate of ammonia, bicarbonate of potash, nitric ether, and 5 minims of Fleming's tincture of aconite may be administered every four hours. After the purgative has been given, diuretics, to which half a drachm of calomel may be added in cases which have not followed some debilitating disease, may be administered once daily in addition. Tincture of colchicum is recommended by some. The affected limb should be fomented with warm water, and if the pain is severe, tincture of opium may be added to the water, or it may be applied with other anodynes as a lotion after each fomentation.

The diet should be carefully attended to. In the early stages a restricted and cooling diet should be ordered, but in the later stages, when debility supervenes, the diet should be nutritious and well regulated, and the limb should be supported by bandages applied pretty firmly.

Where the limb is much thickened, iodide of potassium or tincture of iodine may be given internally, and the ointment of iodine may be used externally, and continued while the animal is at work.

BURSATEE.

Definition.—Bursatee is a disease probably due to a vegetable parasite belonging to the moulds or hyphomycetes, characterized by peculiar slow structural changes in external wounds, in the subcutaneous tissue, or in internal organs, or in all these situations.

Distribution.—Bursatee is an Indian disease probably peculiar to the horse, deriving its name from 'Bursat,' which signifies 'rain,' from the association of this malady with the rainy season. But probably it is most frequent in the time just preceding the wet season. It occurs throughout the Indian Empire, especially, however, in the northern parts, and is more commonly met with on the plains than in elevated situations.

Etiology and Nature.—Bursatee is in all probability due to a special fungoid growth, and in the *Veterinary Journal* of July, 1884, Mr. F. Smith says that he has found a mould fungus in every fresh specimen of the sore which he has examined. The filaments of the mould, or hyphæ, as they are termed, are here recorded to be $\frac{1}{20000}$ inch in diameter, and of great length. He has not observed any spores. In the propagation of bursatee, flies have been asserted to play a prominent part, and water also is said to be a means of disseminating the disease. The lesions found in bursatee have been compared with cancerous growths, but there appears to be but little analogy between them. Mal-hygienic conditions appear to favour the development of the disease, and it is said to be commoner in stabled animals. Whether bursatee can be transmitted from parent to offspring is an unsettled question. Bursatee is probably non-contagious.

Symptoms.—The special feature of bursatee is the appearance of peculiar growths termed 'kunkurs.'* These are mainly found in those situations which, from their position, are most liable to be the seat of wounds from any cause. The subcutaneous tumours are first noticed as soft nodulated swellings. In about eight or ten days from their first appearance they become hardened, until they become as firm as fibroid tumours. After a variable period the tumour ulcerates, and a bursatee sore or ulcer results. The sore is indolent, and has a papillated appearance, and discharges a small quantity of pus. The edges of the ulcer are slightly raised and undermined, and on the floor are scattered little hardened eminences called kunkurs, which may be squeezed out. The sores have but little tendency to spread, though in some cases they do increase in size, and neighbouring sores thus become confluent.

The reparative material is also of the nature of the kunkurous growth, and the cicatrix formed in healing is of a greyish colour.

Ulceration and cicatrization may go on together in different parts of the sore, and the whole scab may be thrown off, forming an unhealthy ulcerated surface, or it may be fissured, and discharge a grumous matter. The inner canthus of the eye is often the seat of the affection, and from thence it may cover a considerable area of the face;

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* *Kunkur* is the native term for a stone used in India for economic purposes.

probably the irritation of the tears sets up a condition suitable to the growth of the fungus. The angles of the mouth are also frequently affected, and the bit may cause the original injury, which afterwards takes on a bursatee form. The legs, from the knee downwards, especially the fetlocks and coronets, are often affected, and in these situations the growth has a tendency to assume more the character of bone than in other parts. The vagina, urethra, glans penis and prepuce are also frequently affected. The site of an old sore always affords a soil for the peculiar growth in affected animals, and fresh wounds similarly undergo the above changes. Cicatrization rarely or never occurs spontaneously, and with the return of the season there is great probability of recurrence of the disease on some other part of the body. A cicatrix, if external, may lead to impairment of function of the parts involved. The general condition varies in bursatee, but there is usually more or less debility.

Morbid Anatomy.—The lesions of bursatee are found in external wounds, in subcutaneous tissues, and in internal organs, or in two or all three of these situations. They may be found in the internal organs of animals which have shown no signs of the disease during life. In size, the growths vary from a millet seed to a filbert nut. In the early stages, microscopical examination shows them to be composed of two kinds of cells. One kind of cells have a tendency to elongate into fibres, the other have abundant nuclei and nucleoli. In the next stage the growths are firmer; the section is yellowish white. Many of the more stable and less active cells have become converted into fibrils, while the other cells, dispersed among them, are of a brownish colour.

This is the stage of soft kunkur. In a still later stage, the tissue is harder, and the greater part of it is in a condition of calcareous metamorphosis. In the internal organs, the kunkurous growth has been observed to have a fibrous capsule. The growths have been found in the liver, spleen, mesenteric glands, cæcum, lungs, pleura and bronchial glands, salivary glands, and submucous tissues of the urethra, and in other situations.

Treatment.—Attention to the hygienic conditions and nutritious diet are of first importance. Tonics may be given from the onset of the disease. The sores should be dressed with antiseptic lotions of carbolic or sulphurous acid, or eucalyptus, etc. All vegetating growths and masses of kunkur should be excised or removed by the actual cautery. It is essential that the whole of the growths should be excised, as otherwise the growth will recur. After excision the wound may be dressed with lunar caustic or sulphate of copper in order to stimulate the healing process.

DIABETES.

Varieties.—(1) Diabetes insipidus, or polyuria or hydruria.

(2) Diabetes mellitus.

Definition.—Diabetes is a diseased condition accompanied by excessive secretion of urine, great thirst, emaciation, and debility, and in the second variety characterized by the presence of grape sugar or glucose in greater or less amount in the urine.

DIABETES INSIPIDUS—Nature of Disease.—Diabetes insipidus is the commoner of the two forms of diabetes in the horse, and is regarded by some merely as a functional disease of the kidneys. It is, however, rather to be looked upon as a general affection due to some disordered condition of the assimilative processes.

This disease is so common among horses under certain conditions, that although usually a sporadic affection, it occasionally develops truly enzoötic characters (Robertson).

Etiology.—It is probably caused by disordered condition of the vaso-motor centres, leading to dilation of the renal vessels, and thus causing polyuria. The disordered innervation is probably due to defective assimilation, brought about by improper diet or by causes peculiar to the locality.

Mouldy hay, musty, damp, or kiln-dried oats, and bad corn, are fertile sources of the disease. Boiled food is also sometimes a cause of diabetes insipidus. In some cases the disease may come on in the absence of such causes, and it is then of a most severe type, and usually due to malassimilation of food and other causes, such as prolonged exertion and exposure to cold.

During convalescence from some debilitating diseases, even slight dietetic errors may induce polyuria.

Symptoms.—Excessive urination, great thirst, anorexia or depraved appetite, are the diagnostic symptoms. The mouth has a sour, unpleasant odour, and the skin is scurfy. The pulse varies in number, but the volume is diminished and the tone deficient. The visible mucous membranes are pale, and the animal is enfeebled and perspires on slight exertion. The urine voided is pale, of low specific gravity, from 1002 to 1003, but the total amount of solids is probably not diminished. According to Lassaigne, it contains free acetic acid, and alkaline carbonates are absent. When this form of diabetes follows some debilitating disease, the urine is of higher specific gravity, and the debility and wasting are more marked.

When the disease continues unchecked, the animal gradually loses strength, becomes emaciated, and structural changes follow in many organs. Dropsical effusions into the serous cavities and the lax connective-tissues are then of common occurrence.

Morbid Anatomy.—General pallor and loss of tonicity of the muscles, and soft flabby condition of the large glands of the abdomen, are noticed. In the brain and spinal cord there may be serous effusion into the sub-arachnoid spaces, or infiltration of the membranes with a gelatinous matter.

Treatment.—Change and careful regulation of the diet are essential. At first the food should be restricted to hay and mashes, and the animal should be rested and carefully attended to for a few days.

Mild aperients should be given, and bicarbonate of soda or potash allowed freely in the drinking-water. The alkaline salt is especially called for when the horse exhibits a depraved appetite by eating the mortar or licking the walls.

Iodine and iodide of potassium are the most valuable of internal remedies, and, indeed, are regarded as specifics. The compound tincture of iodine may be prescribed, or iodide of potassium may be given in the drinking-water in two-drachm doses twice daily. Vegetable tonics may also be administered.

Other remedies often used are sulphate and perchloride of iron, and arsenic in the form of Fowler's solution.

DIABETES MELLITUS.—This disease is rarely met with in the horse, and its pathology is very obscure.

Etiology.—The glycogenic activity of the liver appears to be increased in this disease, and thus more glycogen is converted into glucose and thrown into the circulation than can be used in the economy. The surplus is thus excreted by the kidneys. Whether this increased functional activity is due to direct nervous influence on the hepatic cells, or whether it arises from vaso-motor disturbance producing dilation of the hepatic arteries, or lastly, whether it be in some cases due to the former, and in other cases to the latter, is uncertain.

Symptoms.—There is excessive elimination of urine, indigestion, thirst, and the various other symptoms of polyuria are present. The urine has a fragrant smell, and is of higher specific gravity, and when tested is found to contain glucose or grape-sugar. It may be tested for by Trommer's test, or by using Pavy's test pellets, now specially manufactured for the purpose. The fermentation test may also be applied.*

Treatment.—The diet should be nourishing, and as nearly as possible devoid of purely saccharine or starchy matter. Opium, or codeia, one of its alkaloids, may be given twice daily. Mineral acids, iron salts, and astringents, as gallic acid, are also recommended.

AZOTURIA.

Definition.—Is a diseased condition characterized by tonic or clonic spasms of the large muscles of the posterior part of the body and of the limbs, and by the elimination of nitrogenous, darkly coloured urine of high specific gravity.

Nature of the Disease.—Azoturia is the result of an oversupply or excess of proteid material in the system.

The muscular elements are probably more involved than the other structures of the body, and the condition of the urine is the result of the pathological changes which have taken place.

The phenomena of the disease are intimately associated with mal-nutrition, and may originate from this cause, or also from a disordered condition of the nerve-centres, or from both causes.

Etiology.—The primary cause of azoturia is dietetic. The disease may attack animals out at grass, and it is especially apt to follow periods of idleness preceded by active work. It does not so much occur during the actual rest as when the animal again resumes work. Tares, vetches, and other leguminous vegetables, are especially apt to induce this serious malady. Horses fed with materials rich in proteids during a state of rest are the most subject to attack. It is most common during autumn, and it has been observed to be of more frequent occurrence among mares than among geldings.

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* For particulars as to examination of the urine, see 'Urine in Health and Disease.'

This is especially the case during the œstrum, when the excitability of mares is increased.

Symptoms.—The symptoms of azoturia come on suddenly, without any previous warning or indication of disease. Horses may be attacked when in the stable, or, as more commonly occurs, when they have travelled a short distance after a period of rest.

In the latter case they become suddenly lame, or have such difficulty in moving the limbs, generally the hind ones, that they are scarcely able to move. In some cases they are, as it were, struck down suddenly from loss of motor power in the posterior extremities. In other instances the attack is not so sudden; the animal becomes very restless, perspires freely, and shows a disposition to lie down, and very shortly the characteristic symptoms appear, if not already present. There are tremors and violent spasmodic twitchings of the large muscles of the loins and gluteal muscles, ending in tonic contraction or more or less total loss of power. The perspiration may be excessive. The urine discharged is high-coloured, thick, and of a brownish tint. The specific gravity is always much increased, and may reach 1185 or even more, and is highest during the first few hours after the attack. It often gradually diminishes afterwards.

The pulse varies from 60 to 80 beats per minute, and is generally weak, though in some cases, on the contrary, it is strong.

The temperature varies from 102° to 104·5° or even higher.

The bowels may be regular, and in slight attacks the appetite is not impaired. In severe cases the animal lies prostrate, generally unable to rise; refuses to eat or drink; struggles violently in his attempts to raise himself, and partial coma may then supervene. There is also in such instances much congestion of the conjunctivæ. While the animal remains thus prostrate, there are periodical strainings and ejections of small quantities of urine, or there may be constant involuntary dribblings.

The urine, if carefully examined as soon as possible after being voided, will be found to be loaded with urea. Indeed, so abundant is this product, that if nitric acid be added to a portion of urine in a vessel, the whole becomes almost solid, from the formation of crystals of nitrate of urea. Albumen is not generally found, though in some cases the solidification is in part due to the coagulation of a small amount present.

The crystals of urea-nitrate appear as mica-like rhomboid scales of a brownish colour, and fall to the bottom of the vessel. At first the addition of the acid causes effervescence, from the presence of ammonium carbonate in the alkaline urine, but after the effervescence is over, urea is readily precipitated.

If the serum of the blood be examined, crystals of nitrate of urea may be formed by extracting the urea from the serum and adding a few drops of nitric acid.

Prognosis.—Is very serious in the sudden cases. In some instances the animal is struck down, struggles violently for a few hours, and then becomes comatose and dies.

In other instances, again, the severe symptoms abate; but the animal does not regain the use of its limbs, and although it may eat well and be perfectly conscious, it is unable to rise, and eventually dies from some complication.

In favourable cases the urine gradually becomes normal, the spasms gradually lessen in severity, the power of movement returns, and in a few days the animal is convalescent.

In other cases for a long time the loss of power in certain muscles remains. Not in all cases is there recovery when the urine becomes normal, for the cerebral complications may still continue, and death ensue in consequence.

Diagnosis.—The only diseases which are likely to be confounded with azoturia are anthrax and cerebro-spinal meningitis.

Morbid Anatomy.—There is general congestion throughout the body, especially in the glands of the abdomen. The bladder contains thick brownish fluid, and its lining membrane is similarly stained. The nerve-centres may be more or less hyperæmic, and the blood is found to be dark and semi-fluid.

Treatment.—The animal should be placed in a well-ventilated loose-box, with plenty of straw.

It is of the first importance to act freely on the excretory organs. For this purpose, a cathartic or oleaginous purgative should be given at once. A full dose of aloes in the form of a ball is probably the best aperient in this condition. Enemas should also be administered at intervals until purgation begins.

The great thing is to induce profuse perspiration. Tincture of jaborandi coupled with liq. ammonii acetatis in suitable doses may be of the greatest possible value.

If there be much fever, the solution of acetate of ammonium or other febrifuge may be given in the drinking-water, which should always be kept near the animal, and should not be restricted in amount. Stimulants and sedatives are harmful in the early stages, and should not be given; but if on the third or fourth day the animal shows no signs of improvement, moderate doses of alcohol or of nitric ether should be allowed three times daily. In cases where there is any indication of failure of the heart's action, stimulants should be given freely; but ammonia and its compounds are not to be recommended, as the blood is already surcharged with nitrogenous waste-products.

If the animal is unable to rise, he should be raised by means of slings, in which he may be allowed to remain for a few days. He may be taken out occasionally for a little exercise. If he seems disinclined to stand, the limbs may with advantage be briskly rubbed.

Fomentations on the loins by means of woollen cloths wrung out from warm water are recommended by some, but this treatment is viewed with disfavour by Professor Williams, as likely to increase the irritability of the animal.

The diet for the first few days should be restricted, and of a light, easily digestible kind. When convalescence is being established, it should be moderately nutritious. A few doses of nux vomica may be given with advantage after the discontinuance of the febrifuges.*

OXALURIA.

Definition.—Is a condition of the system characterized by the presence of oxalate of lime in the urine, debility, loss of flesh, stiffness in the loins, and a branny scurf on the surface of the body.

Etiology.—The causes are: irregularity of feeding; irregular exercise and work; want of sufficient exercise; improper diet, and impaired digestion from any cause. Oxaluria is most commonly met with in hunters, or other horses whose work is irregular, and which undergo long periods of fasting. It is also induced by food rich in saccharine matter, as carrots, turnips, or other roots, especially if the digestion be deranged.

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* We believe pilocarpin injected hypodermically to be of great value in the early stages of the severe forms of azoturia, in addition to the cathartic remedies and febrifuges, though as yet we have not had sufficient experience of this disease to assert that this remedy may always do good. It is a powerful diaphoretic, and acts by enabling the blood to throw off the excess of effete matter.

The phenomena of azoturia, indeed, seem to be dependent upon the accumulation of urea in the blood, owing to its increased production, and also to failure of the kidneys to eliminate this excess. Further, they are probably dependent upon the decomposition of this substance in the blood. Further experience does not confirm the use of pilocarpin in azoturia. Since writing the first edition of this work, we cannot say that the value of pilocarpin has been proved in practice.

Symptoms.—The animal is stiff in the loins, and easily fatigued; he loses flesh, the skin becomes dry and scurfy, the appetite is capricious, and there is frequent voiding of a pale-coloured urine, often accompanied by uneasiness.

The bowels are often constipated, and the tongue furred.

The urine is clear, pale, and acid or neutral in reaction, and when examined under the microscope shows crystals of oxalate of lime. These are either in the form of octahedra or very rarely dumb-bell shaped.

Treatment.—Firstly, it is necessary to administer a purgative. The diet should be carefully regulated, and roots and food containing much sugar should not be allowed. Vegetable tonics and mineral acids should be given to improve the digestion. For this purpose diluted nitro-hydrochloric acid, tincture of nux vomica, and gentian may be administered three times daily. If the drinking-water contain lime in excess, it should be changed, as other remedies will not effect a cure if there be an excess of lime in the system.

Regular exercise and fresh air are essential.

STOMATITIS PUSTULOSA CONTAGIOSA.*

Several cases of this contagious disease are reported as having occurred at Berlin during the summer of 1876.

* For full description of this disease, vide *Veterinary Journal* for November, 1878.

The horses were from four to five years old. Some of them stood with depressed and outstretched heads. The ears and extremities were cold. The pulse was about 60 per minute, and the respirations were normal. There was no loss of appetite even in the worst cases, but the animals masticated slowly, swallowed with difficulty, and saliva in abundance was secreted.

There was a greenish discharge from the nostrils, and when water was taken, much of it returned through the nose.

The Schneiderian membrane was of a rose-red colour. The submaxillary glands were enlarged on both sides; they were hard, firm, and about as large as hen's eggs. They were not attached to the skin or bone. The oral mucous membrane was hot, red, and covered with a tenacious secretion, and many small firm nodules, varying in size from a millet to a lentil seed, could be felt in it. The nodules increased in size and number rapidly, and soon appeared on the cheeks, and on the upper and lower surface and frænum of the tongue. In one or two days later the summits of the nodules presented a whitish appearance, or the epithelium was removed and a small ulcerated surface became apparent. In four or five days later the ulcerations were numerous, the dental surface of the lips, and the top of the frænum and inferior surface of the tongue being especially affected. About the sixth to the eighth day the ulcerations began to heal. The disease ran its course rapidly, and all the cases under treatment recovered in from twelve to fourteen days.

This disease, on superficial examination, might be mistaken for glanders, but there are important differences between the two. In the former the ulcers were round, with sharply-defined borders, varying in size from a fourpenny-piece to a shilling, and the edges were neither serrated nor swollen, as in glanders. Further, the ulcers were superficial, rarely reaching as deep as the subcutis, and they readily healed after the sixth day. They were isolated and independent of the course of the lymphatics, and when the brownish scab was removed they presented a whitish granular surface. The disease only lasted from twelve to fourteen days, and ran through a whole stable in three weeks or so.

This disease, therefore, differs from glanders in the character, distribution and rapidity of the healing of the ulcerations; in the absence of inflammation of the absorbents; in the absence of ulcerations on the Schneiderian membrane, and finally in the rapid course of the disease, in the shortness of its latent period, and in the rapidity with which it spreads from one animal to another.

Stomatitis pustulosa also resembles variola equina, but it cannot be regarded as true equine variola.

The following article on 'Contagious Pustular Stomatitis in Horses, and on the Communication of this Disease to Two Men,' written by ourselves, is taken from the *Veterinary Journal* for 1885, vol. xxi., page 88:

'In bringing before the notice of the readers of *The Veterinary Journal* the subject of contagious pustular stomatitis, as illustrated by four cases, two in horses and two in men, I wish to express, in the first place, my opinion that when carefully studied this disease seems to have no more special relationship with equine variola or other exanthems than, indeed, the various specific fevers have one with another.

'In short, I am led to regard contagious pustular stomatitis as a distinct eruptive fever, characterized by a local eruption, coupled with febrile manifestations and sore throat, and this opinion I have arrived at more especially from a careful scrutiny of the cases now under consideration.

'On the 27th of May I was asked to see a seven-year-old cart-horse, which was slavering profusely. On examination of the mouth, the whole of the epithelium underneath the tongue and on the inside of the cheeks was found to have peeled off in flakes, and the raw surface left was studded copiously with little rounded ulcers, each of about two-thirds the size of a threepenny-piece. Many of the ulcers became confluent on the following day, forming large ulcerated surfaces. There was no eruption in any other part of the body excepting one solitary ulcer on the nose, about half an inch from the mouth. This soon healed. The mucous membrane of the mouth was hot, dry, and red, and was covered with a tenacious sticky secretion.

'The pulse was sixty per minute and regular, the respirations were not accelerated, and the temperature did not reach beyond 102·5°. The animal masticated and swallowed with difficulty, but there was no loss of appetite. Saliva was passed out in great quantity; there was no discharge from the nostrils, but the Schneiderian membrane was of rosy reddish hue, and the submaxillary glands were slightly enlarged, but were not adherent to the skin or to the subjacent bone. About the seventh day from the commencement of the disease, the ulcers began to heal, and the horse made a complete recovery in a fortnight.

'The shepherd on the farm, who had the horse under his charge, had given an aloes ball to the animal as soon as he noticed him ailing, and in so doing received a slight scratch on the second and third finger of the right hand. His right arm began to swell about ten days afterwards, but he went to work nevertheless. The swelling then became more severe, the patient took to his bed, and pustules formed and burst about the twelfth day after the arm first began to swell. There were then five ulcerated patches on the back of the wrist as large as sixpenny-pieces, but oval in shape. The man made a gradual recovery, but he had very high fever, profuse salivation, and dry, parched mouth, and his throat was very sore. There was no rash in any other part of his body. Several days after the first horse was attacked, another animal, a four-year-old horse, was noticed to be ailing, and numerous ulcerated patches were found on the inside of the cheeks; the whole of the tongue was red and raw, and there was profuse slavering; the appetite was not much imparied, but deglutition and mastication were difficult. The other symptoms were the same as in the former case, but the submaxillary glands were not affected. Little depressed cicatrices remained on the place of the ulcers, but they gradually disappeared. The nostrils were not affected, but the Schneiderian was of a rosy hue. The foreman who had attended this case became inoculated from his charge, and about ten days after receiving a slight abrasion on the finger, his arm began to swell, and then ulcers were formed on the back of the hand and on the wrist. The disease proved milder in this case than in that of the shepherd, but there was more affection of the mouth and more salivation than in his case.'

CHAPTER V.

DISEASES OF THE RESPIRATORY ORGANS.

METHODS OF PHYSICAL EXAMINATION, AND THE SIGNS AFFORDED BY THEM.

THE various methods of physical examination of the respiratory organs are:

INSPECTION.—When we inspect or look at the chest, we have two sets of facts to observe—

Firstly, the shape or form of the chest;

Secondly, the number and the character of the movements of the chest during respiration.

When the respirations are increased in range above the normal, they are said to be exaggerated, as, for example, in certain febrile affections; when decreased below the normal, they are said to be deficient or impaired, as, for instance, in certain diseases of the brain.

When the movements are deficient, less air enters the lungs than is necessary, and dyspnœa, or shortness of breath, will result.

Dyspnœa may result from two opposite conditions; the lungs may either be prevented from expanding or from contracting as much as in the normal condition. The former is termed 'defective inspiration' or 'deficient expansion,' and the dyspnœa is said to be 'inspiratory;' the latter is termed 'deficient expiration,' and the dyspnœa is called 'expiratory.' Again, disturbance of the relation between the thoracic and abdominal movements may be detected. Thoracic movements in excess may be due to interference with the action of the diaphragm or abdominal muscles, as in peritonitis. Abdominal movements in excess may result from causes impeding the action of the chest-walls, as in pleurisy.

PALPATION.—By palpation, or the application of the hand to the walls of the chest, we may feel the shape and movements of the walls, and whether there be any tenderness or not. Occasionally also abnormal sensations, as pleuritic friction, may be felt.

MENSURATION.—This method is not much practised in veterinary medicine in this country, but is recommended by French veterinarians.

PERCUSSION.—This method consists in tapping the walls of the body so as to cause them to yield a sound. Percussion may be either direct (immediate), when we strike the surface with the tips of the fingers, or with the knuckles of the closed hand; or it may be indirect (mediate), when we percuss upon something placed upon the skin.

In the direct method, which is the more convenient in examining horses, it is best to strike over the surface of a rib, and as perpendicularly as possible. In the indirect method, the intervening body, whether it be a finger or a pleximeter, should be pressed closely to the surface of the body.

If the walls of a cavity containing air be struck, a hollow, resonant, or low-pitched sound is obtained. On the other hand, if a solid mass, as for instance the thigh, be struck, the sound produced is dull, non-resonant, or high-pitched. A very resonant note is said to be tympanitic (*tympanum*, a drum).

If the walls of the chest be percussed where the lung is in close contact with the walls, a fairly resonant note is heard in health, the sound depending on the vibration of the air in the pulmonary tissue, and on the vibration of the chest-walls themselves.

General increase of resonance occurs in the chest in cases of pulmonary emphysema. Partial increase may occur over areas where the lung has become more functionally active, and dilated in consequence, from loss or impaired function of the rest. Diminished resonance may occur from any cause obstructing the entrance of air into the vesicles of the lung. Loss of resonance may be due to hepatization of the lung or to effusion into the pleural cavity.

AUSCULTATION.—By auscultation we mean listening to the sounds of the interior, either directly, by application of the ear to the surface, or indirectly, by means of a stethoscope. In the normal condition, auscultation of the respiratory organs of the horse reveals at least three typical sounds:

1. Tracheal, Laryngeal or Nasal Breathing.

This may be heard over the larger cavities of the head, the larynx, and the trachea.

It is a soft blowing murmur, audible during inspiration and expiration, between which there is a short interval.

2. Bronchial or Tubal Breathing.—This breathing is harsher, and of shorter duration and less intensity, than the tracheal. The interval, also, between inspiration and expiration, is less marked. It is best heard at the bifurcation of the trachea, at the anterior part of the chest.

Over the superior and middle third of the chest it is less characteristic, and is most distinct in the upper third.

3. Pulmonary or Vesicular Breathing, or Respiratory Murmur.—The respiratory murmur is due to the entrance of air into the vesicles, or to conduction of the laryngeal sounds along the bronchi and small tubes, and their modification by having to pass through the vesicles, or it may be due to both these causes.

It is a characteristic soft breezy murmur, heard in inspiration and expiration, between which there is an appreciable interval. The expiration is very faint or inaudible. The murmur is louder in the young than in aged animals, and may be heard in the horse over the greater part of the chest, and is most distinct in well-bred horses, and in those in which the chest-walls are not loaded with muscle and fat.

Changes in the Breathing Sounds in Disease:

1. In the Anterior Air-Passages.—In some horses the nasal sound is abnormally increased in exercise. This sound is louder in expiration than in inspiration. It is best heard during trotting or cantering gently, and usually disappears when the horse is going at a good steady gallop.

It arises from the flapping of the nostrils, and constitutes what is improperly termed 'high-blowing.' Professor Williams says, 'I have repeatedly observed that some horses will emit the sound when first put into work after resting a while, but when brought into condition the sound entirely ceases, and I have thought that the sound was due to flaccid condition of the dilatores naris muscles.'

High-blowing may also be due to narrowness of the nasal apertures and passages.

These conditions as they do not interfere with the usefulness of the horse, cannot be said to constitute unsoundness.

In thickening of the Schneiderian membrane, or when abnormal growths occupy the air-cavities of the head, a more or less blowing sound may be heard.

In some instances, if the obstruction be very great, the sound may become of a whistling character; this, however, is rare. It may be mistaken for a sound originating in the larynx or lungs, but auscultation will tell us where the sound is produced.

Snoring is diagnostic of polypus, and snuffling sounds indicate some disorder, accompanied by discharge from the nose, such as catarrh, purpura hæmorrhagica or glanders, scarlatina, etc.

A dry wheezing or whistling sound, which persists, indicates narrowing of the aperture of the larynx.

In some cases of asthma a wheezing vibratory noise may be heard along the trachea.

2. **In the Bronchi and Lungs.**—In auscultating the chest, the normal respiratory murmur may be heard to be augmented, and this augmentation may be local or it may be general.

A general increase may be heard as the result of anything which for a time enhances the activity of the breathing. When it is increased over the surface, as the result of the exclusion of air from a neighbouring portion of the lung, it is termed supplementary. When heard over parts of the chest, where it is not audible in health, the murmur indicates an infiltration or solidification of the pulmonary tissues.

The respiratory murmur may also be diminished, and this diminution may likewise be partial or general.

General diminution may be due to various causes, for example, to lessened respiratory action, such as occurs in many cerebral disorders; or it may be due to obstructions, by which the normal expansion of the chest is lessened. The murmur may be entirely suppressed from a variety of causes. The suppression is one of the signs of consolidation of the pulmonary tissues and of pleural effusion.

Again, the murmur may lose its regularity and rhythmic character. It may become oscillating or interrupted in various ways in certain phases of pleurisy, or the expiration may become prolonged, as in emphysema. Finally, the murmur may be altered in character.

If it become of higher pitch, louder and more prolonged in expiration, it is then said to be '*exaggerated*' or '*harsh breathing*,' and indicates changes in the consistence of the lung-tissue, depending upon compression in the early stage of bronchial and pulmonary inflammation. This harsh breathing may subside and the breathing become normal; or, on the other hand, if the disease progresses, it may become replaced by a very characteristic kind of breathing, very important in diagnosis, termed '*Bronchial breathing*.'

Bronchial Breathing is similar to the variety of breathing above described as being audible in the normal condition at the bifurcation of the trachea at the anterior part of the chest, but is louder and more distinct.

When it is heard over parts of the chest where it is normally absent, it indicates disease, and is a marked sign of consolidation of the lung. Sometimes it is heard in emphysema.

Cavernous and amphoric breathing are varieties of breathing only heard in disease. They approach the normal laryngeal or nasal sound, but they have a greater hollowness. They are only heard in rare instances, in cases where the air-tubes are in connection with cavities in the lung-tissue.

New Sounds heard in Auscultating the Respiratory Organs.—We have as yet only spoken of sounds the analogues of which may be heard in health. We have now to consider sounds only heard in disease. They fall under two headings: (1) Those produced in the lungs, pulmonary; and (2) those produced in the pleural cavity.

1. **The Pulmonary Sounds.**—To these sounds the term 'râles' is applied; and they may be divided into crepitation, rhonchus, and sibilus.

Crepitation.—Crepitation is produced by the bursting of air-bubbles in fluid, and is spoken of as large, medium, and small, according to the supposed size of the bubbles which produce them. Crepitation has, therefore, been spoken of as moist sounds in contradistinction to rhonchus and sibilus, which are dry sounds.

Very fine crepitation is, however, probably due to the separation of the walls of the air-vesicles in inspiration, when, as the result of pressure or collapse, they have been in partial contact. Crepitation similar to this, but not similarly produced, is also occasionally heard over emphysematous lungs.

Rhonchus and Sibilus.—These sounds are due to vibration in the air, through bronchial tubes in which the mucous membrane has become altered or roughened by inflammation or secretion.

Rhonchus is produced in the large tubes and is deeper in tone. It is described as a snoring, cooing, or grating, according to its special character in different instances.

Sibilus is produced in the smaller tubes, and is a wheezing noise, more hissing in character than rhonchus.

2. Pleural Friction.—In health the surfaces of the pleuræ are smooth, and move upon each other without producing any sound. When the pleuræ are roughened by disease, the rubbing of the two roughened surfaces produces a sound to which the name of 'friction' is applied. Friction, being produced in the pleura, sounds close under the ear, and is double, owing to the movement of the lungs to and fro.

It may be very limited in extent.

When effusion into the pleural cavity takes place, the surfaces of the serous membranes are separated, and the friction thus disappears; but when the inflammation subsides, and the fluid is reabsorbed, the two layers come into contact, and the friction is heard again, and is termed 'redux friction.'

Other Sounds sometimes heard in Auscultating the Chest under Certain Conditions. — **Metallic Tinkling** is a sound caused by drops of fluid falling from the walls of a cavity into the fluid below. It resembles the sound produced by drops of water falling into a well.

Gurgling Sounds are due to the liberation of air-bubbles from effused material.

Cough Resonance.—If we listen to the walls of the chest of a healthy horse, as he coughs the sound is heard as being of a soft, dull, indistinct character.

In pulmonary disease the character of this cough resonance is altered. For instance, in hepatisation, or compression of the lung from effusion, if the horse be made to cough while we listen to the chest, the sound produced is much louder and more distinct and harder over the involved area than in the normal condition.

CERTAIN SYMPTOMS ASSOCIATED WITH DISORDER OF THE RESPIRATORY ORGANS.

GRUNTING.—If a horse when struck or suddenly moved makes, during expiration, a grunting noise, he is said to be a 'grunter.' The emission of this sound is always to be looked upon with suspicion, as it generally accompanies whistling and roaring. It may or may not be due to disease of the larynx. A horse may grunt from pain, when suffering from pleurisy, pleurodynia, and other disorders, and some horses grunt when struck at or moved suddenly. Roarers are not always grunters, nor are grunters always roarers. The point is, therefore, one which cannot be altogether relied upon.

A large number of cart-horses, and large horses of all breeds, are apt to be grunters, being nevertheless quite sound in their wind. Any horse also may grunt if he has been fed for a time with bulky food.

COUGHING.—Cough is a modification of breathing, characterized by a deep drawn inspiration, followed by closure of the glottis, and one or more short but violent expiratory acts. It is generally excited by irritation or abnormal accumulation at the glottis, in the trachea, or in the larger bronchial tubes, or it is a simple nervous affection.

Cough is dry or moist. Dry cough is of several varieties; short, hollow, hacking, broken-winded, and spasmodic. Dry cough is characteristic of irritation, and of dryness of the respiratory mucous membrane. In the early stages of laryngitis it is long and loud and sonorous, becoming rasping, and afterwards moist.

In chronic diseases of the larynx it is loud and often hollow. In the early stages of bronchitis it has a hollow metallic sound, and becomes moist afterwards, and is more or less painful throughout the disease.

In pneumonia the cough is short, and in the later stages of the disease it is accompanied by expectoration of a rusty-coloured tenacious secretion.

The cough of pleurisy is dry and hacking, and is sometimes broken, as it were, in the middle. The broken-winded cough is at first spasmodic, becoming, as the disease advances, feeble, short, and single: the horse, being unable to relieve himself by the action of the chest and lungs, gives a suppressed cough, which is characteristic. The hollow cough varies in intensity, and is indicative of chronic disease. Moist cough is indicative of an inflamed and humid condition of the respiratory mucous membrane.

WHISTLING is of two kinds—soft or moist, dry or hard. Soft whistling occurs in acute laryngitis, when there is considerable increase of mucus, and also when the mucous membrane is temporarily swollen. If it be occasioned by a large amount of mucous secretion, it is of a wheezing character, and is mostly diminished when the horse coughs. If it arises from inflammatory infiltration of the laryngeal mucous membrane, it is louder during inspiration than in expiration.

Soft Whistling constitutes temporary unsoundness, and it is, in many cases, unsafe to hazard a decided opinion for some days or even weeks, until the thickening of the mucous membrane and relaxation of the vocal cords has had time to subside.

Dry Whistling.—According to some authorities, dry whistling is to be regarded as a modified form of roaring. Others, however, are of opinion that whistling and roaring are due to different pathological conditions of the larynx, and that they may exist independently of each other. With the latter views we entirely concur.

Dry whistling, like roaring, is a noise made more especially during inspiration. It is due to diminished calibre of the larynx, and sometimes of the trachea, owing to permanent thickening of the mucous membrane, distortion of the neck by tight reining, the presence of a tumour in the trachea, or to any cause which diminishes the calibre of the passages through which the air passes to and from the lungs.

Whistling, though loudest in inspiration, is by no means always absent during expiration.

If entirely absent during expiration, the pathological change is to be sought in the larynx, or upper part of the air-passages.

Whistling, like roaring, is often traceable to hereditary taint, and constitutes unsoundness.

LARYNGISMUS PARALYTICUS ATROPHICA (commonly called 'Roaring').—The chief point about roaring is that it is generally transmitted by heredity, and does not appear so much to be due to actual disease. Roaring may be said to be the production of a loud and unnatural sound made during the inspiratory acts.

Diagnosis and Symptoms.—Two distinct noises may be made out.

The disease usually commences in horses at about the age of three or four years. It begins so slightly that at first it can only be detected by an experienced observer who is thoroughly well used to the task of detecting this disorder. Then the animals become progressively worse. The sound is first purely laryngeal in the earlier stages of the disease, and afterwards becomes complicated by reason of the great difficulty experienced in respiration. The horse loses control of his power of inspiration, and tries, so to say, when severely affected, almost to fight for breath. Efforts are made to gulp in mouthfuls of air. The horse seems to lose his head, as it were, and all power, or most of the power, of co-ordination in regard to respiration, both inspiratory and expiratory, seems to be lost. The worst difficulty is that experienced in regard to inspiration, or, at any rate, this seems to be the case. The great difficulty in breathing leads to a vibratory movement of the false nostrils, whereby much more noise is made even than in the larynx itself.

The best way to detect roaring is to ride a horse at first gently, and then at a steady gallop—if possible, in a ploughed field. In some cases it is not very easy to detect roaring; for instance, if a horse be what is called a 'high-blower,' when the animal flaps his false nostrils and makes so much noise as to obscure almost entirely the milder sounds made in roaring itself. A horse may, of course, be a high-blower and still not be a roarer; or he may, on the other hand, be a roarer and not a high-blower. The danger is that an inexperienced man may think a horse is only a high-blower when in reality the animal is also a roarer, but the sound of roaring may be very difficult to distinguish.

If a horse has not been ridden, or is a cart-horse, or if the observer does not like to ride him (for any reason), then he should be lunged round and round in a circular run out in a field or in a crew-yard. The observer remains anywhere near, and the horse's squealing out, if he be a bad roarer, will be easily heard.

Roaring is generally due to atrophy and fatty degeneration of certain muscles of the larynx, especially those which pass between and attach the arytenoid cartilages to the cricoid posteriorly. The origin of the degenerative changes in the muscles leading to the paralysis is not certainly known. The disease is generally confined to the left laryngeal muscles, and many have supposed that this is due to the fact that the recurrent laryngeal nerve passes from the pneumogastric at a more distant spot than does the corresponding nerve of the right side, and that, moreover, the nerve on the left side winds round the posterior aorta. According to this view, the left recurrent nerve is thus more likely to be involved in any disease of the chest than on the right side, where it is given off opposite the first rib, and winds round the dorsal artery.

Such an explanation, however, is open to many objections; firstly, roaring is not a common sequel of pulmonary disease; secondly, many roarers have never had any chest affection; thirdly, mares and ponies are less liable to become roarers than large geldings and stallions, but are equally prone to chest affections; fourthly, the nerve itself shows no pathological change, as far as we know; and finally, the atrophic change in the muscles, though usually seen on the left side of the larynx only, is not uncommon on the right side also, though to a less extent.

The disease of the muscles is, however, of an essentially nervous origin, and ought to be classed as a form of wasting palsy—paralysis atrophicans.

Roaring is in most instances gradually developed. As the muscles continue to waste, there is a corresponding and permanent loss of power, and what at first was intermittent is now established.

Most commonly, however, the noise is not intermittent. It is usually slight at first, and then gradually increases with the waste, and consequent inability of the muscles to open the laryngeal orifice.

Causes of Roaring.—Heredity plays a very prominent part in the transmission of roaring. Professor Williams mentions a breed of horses in which nearly all the animals of both sexes are roarers. Horses and geldings are, however, more likely to become roarers than mares, which are rarely afflicted unless the hereditary predisposition is very marked.

Small ponies are rarely if ever affected. An animal predisposed to roaring in most cases suffers from laryngeal affections from very slight causes, and the infirmity usually appears after several attacks of sore throat and cold.

There are other causes of roaring besides those resulting from the condition of the laryngeal muscles above mentioned.

These are not so frequently met with, but are of great importance.

Other Causes of Roaring.—The characteristic sound may be due to disease of the nose: nasal polypi; osseous tumours in the nostrils, or hypertrophy of the turbinated bones; constriction of the laryngeal orifice; tumours on the posterior nares falling into the glottis and causing intermittent roaring; distension of the guttural pouches; tumours in the thorax; disease of the lymphatic glands of the pharynx; injury or disease of the trachea; or, finally, any distortion of the larynx.

The roarer generally has a characteristic cough in addition to the abnormal inspiratory sound. This cough is a loud, harsh, and dry sound.

Most roarers are also grunters in addition.

In testing a horse for its wind, it is customary to place him against a wall and make a feint to strike him. If he grunts he is further examined; if not, he is made to cough by compressing the larynx, and if the cough enforced sound healthy, he is passed. It is, however, best to have the horse galloped, and let him finish his run as he is going uphill. In the case of a draught-horse, the animal may be made to draw a load at a fair pace up an inclined plane, when, if he be a roarer, the characteristic sound will be made. All forms of roaring constitute unsoundness, yet in some cases of recent inflammation of the respiratory organs, the animal may be again examined after a reasonable interval before being finally rejected.

Treatment of Roaring.—In cases of abnormal growths in the nasal chambers, a careful examination should be made with the speculum and by percussion. If a polypus be detected, we may endeavour to remove it if operation is feasible. Similarly, if any removable adventitious growth be found to be the cause of the infirmity, it should be treated according to the requisite surgical methods.

When roaring follows influenza, catarrh, or strangles, it should be carefully treated. The animal should have light work only, and nutritious diet. Potassium iodide, with quinine and liquor arsenicalis may be given in moderate doses twice daily. In addition, the throat should be smartly blistered with ointment of cantharides and biniodide of mercury.

The greater number of cases of roaring met with, however, are due to atrophy and paralysis of the laryngeal muscles.

Many methods of treatment have been suggested for these, which are the most hopeless cases. Blisters or the actual cautery have, however, succeeded in arresting the atrophic change when applied in the early stages to the skin of the laryngeal region.

Potassium chlorate is recommended as worthy of trial for arresting the fatty degeneration. In very bad cases the sound may be lessened by pads attached to the bridle and fitted carefully over the nostrils, so as to regulate the amount of air entering the larynx. If this method is ineffectual, tracheotomy may be performed, and the tube kept in during the rest of the life of the animal.

Probably the galvanic current is of great benefit in the early stages, and is well worthy of careful trial.

Removal of the left arytenoid cartilage has been recommended by Herr Günther, but the cases thus operated on in this country are not sufficiently successful to warrant the general adoption of this method. Bad roarers can be used for slow work; they thrive badly as a rule, and often fall victims to slight disorders.

We may conclude by shortly enumerating the different measures taken to obviate roaring: (1) Electricity; (2) iodide of potassium coupled with tonics; (3) external application of blisters; (4) excision of the left arytenoideus posticus cartilage, together with, perhaps, a small portion of the corresponding vocal cord (at first a small portion only was removed in this operation, and afterwards operators gradually became bold enough to cut away more and still more of the cartilage); (5) tracheotomy in very extreme cases. It is said that cab-horses in which this operation has been performed may be driven regularly. The air may be heard passing in and out of the tube, and this would, of course, be very highly objectionable in the case of horses used for riding.

ACUTE CATARRH.

Synonyms.—Catarrh; coryza; common cold.

Definition.—By the term 'catarrh' we signify a condition characterized by inflammation of the mucous membrane of the nasal chambers, and of its continuation along the upper portions of the larynx and trachea. In this condition there is a discharge from the nose, and occasionally cough and sore throat.

Febrile symptoms are also often present.

Etiology.—Sudden variation in the temperature; exposure to cold and damp; hot, badly-ventilated stables, and contact with affected animals, are among the chief causes of catarrh. Young animals, when first brought up into warm stables, are especially subject to attack. During the change of the coat there is also great predisposition to catch cold.

Symptoms.—Sneezing; redness and dryness of the Schneiderian membrane, followed by discharge, at first thin, but soon becoming turbid, yellowish-white, and profuse. There is also redness of the conjunctival membrane, with discharge of tears and drooping of the head. Febrile symptoms are sometimes manifested, and vary much in intensity. The internal temperature may rise about 3°, or even a little higher. The pulse and respiration are then accelerated, and the appetite is impaired. Debility and general dulness frequently supervene.

Prognosis.—Very favourable.

Treatment.—In mild cases rest from work, in a well ventilated but not draughty or cold loose box, will suffice, with attention to the diet. In all cases where the febrile manifestations are at all severe, febrifuges, as acetate of ammonium, may be given with nitrate or chlorate of potash twice or three times daily.

When the bowels are much confined, enemas of warm water may be administered, and, if necessary, two drachms of aloes may be given.

If the throat be sore and the cough troublesome, we may administer the compound tincture of camphor, or other remedies, in addition to the fever medicine.

In the early stages, while the mucous membrane is dry, inhalation of hot water vapour is useful in relieving the irritation. When the throat symptoms are severe, compound liniment of camphor, or liniment of turpentine, or cantharides should be applied externally. The diet should be laxative, consisting of scalded oats, oatmeal, or linseed gruel and green food.

CHRONIC NASAL CATARRH.

Definition.—A discharge of varying character from the nasal chambers, which may be continuous or irregular.

Etiology.—Most of the cases of nasal catarrh are due to an unhealthy condition of the mucous membrane of the nasal chambers or of the mucous cavities in connection with them, and are the result of protracted and severe cases of acute catarrh. It may arise from other causes, as external injuries, caries of the upper molars, disease of the superior maxillary bone, alveolar abscesses, disease of the facial bones, etc. These latter will be considered under 'Surgery.'

Symptoms.—There is a discharge of a glairy purulent fluid, and the Schneiderian membrane is of a leaden hue, or it may be blanched and thickened with infiltration.

The general health is generally somewhat impaired.

In the case of animals suffering from this disease the breath may be obnoxious.

Treatment.—The animal should be rested, and liberal diet allowed. Salts of iron or arsenic are recommended, with or without vegetable tonics.

As a general rule animals recover if well treated. Iodide of potassium, together with tonics, is very useful.

Locally, lotions consisting of four or five grains of sulphocarbolate of zinc, or half a drachm of sulphate of copper to the ounce of water, may be injected up the nostrils by means of an enema-syringe or through a Rey's nasal funnel. It may be found very difficult in actual practice to carry out this measure. The use of atomized solids is in some instances to be preferred to the application of lotions.

Iodoform, blown into the nostrils by an insufflator, is an efficacious remedy. A very good plan in cases of animals suffering from nasal gleet is to saturate sulphur with strong tincture of iodine, and then place the mixture on hot coals and let the animals breathe the fumes which are given out.

DISEASES OF THE LARYNX.

ACUTE LARYNGITIS.—Definition.—Is an inflammation of the lining membrane of the larynx.

Two forms of acute laryngitis may be distinguished; acute catarrhal laryngitis, and œdematous laryngitis.

ACUTE CATARRHAL LARYNGITIS.—This is the simplest form, and is dependent upon the same causes as common catarrh, of which, indeed, it is usually one of the earliest and most prominent symptoms. There is pain and difficulty in swallowing, and on manipulation of the throat. Usually there is cough ; at first hard and sonorous, but afterwards becoming less resonant.

There is swelling in the submaxillary space and over the parotid region. Nasal discharge may or may not be an accompaniment, although it is a constant symptom when catarrh is also present.

Febrile symptoms are more pronounced than they are in simple catarrh. There is diminution or loss of appetite, elevated temperature, and acceleration of pulse.

ŒDEMATOUS LARYNGITIS.—The structural changes in this form of laryngitis are distinctive. There is excessive infiltration of the submucous tissues of the pharynx and larynx, and the mucous membrane is pulpy and of a leaden metallic hue. In some instances patches of ecchymosis and gangrenous spots are met with on the inflamed membrane. The rapidity with which the infiltration of the laryngeal and neighbouring structures takes place, the suddenness of the onset, and its frequently fatal termination, are distinguishing features of this form of laryngitis. Œdematous laryngitis may succeed what at first appeared as an ordinary case of the catarrhal form, or it may begin suddenly and run a very rapid course. It has also been met with as the result of the inhalation of poisonous acrid vapours and hot air. Sometimes, in a few hours, the swelling and infiltration become very considerable and the breathing much disturbed. The pulse is accelerated, the temperature elevated, and the visible mucous membranes become of a purplish hue, owing to deficient aëration of the blood. The nose is protruded, the superior air-passages being thus made to approach as near as possible a horizontal line. The glottis is indeed sometimes so occluded through excessive infiltration of the structures bounding the orifice as to cause imminent danger to life from suffocation.

Rapid effusion into the submucous tissue and swelling of the mucous membrane is termed 'œdema glottidis.' In these cases the respiration becomes suddenly difficult, and the inspiratory act is especially prolonged, and accompanied with a peculiar harsh sound succeeded by a short expiration. The alæ of the nostrils are dilated to their full extent, the face has an anxious expression, and there is great distress. The extremities are cold, and sweats bedew the body. The animal stamps with its feet, and the distress becomes increased; the visible mucous membranes become more livid, prostration ensues, and the horse, unless relieved, soon succumbs.

Sequelæ of Laryngitis.—Thickening of the mucous membrane; atrophy and degeneration of the laryngeal muscles; and ulceration of the structures bounding the rima glottidis.

Treatment of Laryngitis.—In severe cases the treatment should be as prompt as possible. Inhalations of hot-water vapour, medicated or not, and hot fomentations should be applied, but if the general distress and difficulty in breathing continue. By continuous fomentations and very careful management any necessity for performing tracheotomy may be obviated. It is always wise to use due precautions, and consider well before performing the operation. In order, however, to avert suffocation, tracheotomy may be necessary. The hot-water vapour may be generated by pouring hot water over chopped hay or bran in a nose-bag, and may be medicated by the addition of chloroform or opium, or other drugs.

In mild cases, inhalations, fomentations to the throat, succeeded by stimulating liniments or blisters, are recommended. Febrifuges may be given internally. The diet should be soft and laxative, and the horse should be warmly clad and placed in a well ventilated airy loose box. When deglutition is very difficult it is necessary to give all medicines in the water or food.

Belladonna is recommended for the early stages. This drug is best given in the form of a draught as follows: liquor ammonii acetatis, one fluid ounce; extract of belladonna, one drachm: to be given every four hours until the symptoms abate. During recovery the diet should be as nutritious as possible, and vegetable and mineral tonics should be administered, in order to combat the great prostration usually left in these cases.

DISEASES OF THE BRONCHI.

ACUTE CATARRHAL BRONCHITIS.—Definition.—Bronchitis is a catarrhal inflammation of the mucous membrane of the bronchial tubes. It may be limited to the trachea and large bronchial tubes (simple bronchitis), or it may extend to their ultimate ramifications (capillary bronchitis).

Etiology and Nature.—The causes are predisposing and exciting. The predisposing causes are debility, previous attacks of bronchial inflammation, and cardiac diseases of a chronic nature. The exciting causes are exposure to cold and damp, exhaustion, and irritation of the bronchial membrane by noxious vapours, or by the accidental entrance of fluids or solids into the bronchial tubes; epizoötic influences in some instances, as observed in certain forms of influenza; and lastly, bronchitis as met with in certain specific fevers and under various other conditions depending upon malhygienic conditions.

Varieties.—Acute Bronchitis may be grouped under the following varieties: (1) primary or idiopathic bronchitis, which may involve the larger air-tubes or may extend to their ultimate ramifications; (2) secondary bronchitis, or bronchitis co-existing with specific fevers and other diseases depending on an unhealthy condition of the system; (3) mechanical bronchitis, or bronchitis depending on noxious vapours, fluids, or solids, irritating the lining membrane of the tubes.

1. Symptoms of Acute Bronchitis of the Large and Small Tubes.—Acute bronchitis is usually ushered in with chilliness, malaise, and febrile symptoms, though in many cases these may be trivial.

When fully developed, besides the symptoms of ordinary catarrh, there is a frequent hard and sonorous cough, which becomes softer as exudation into the bronchi increases in the progress of the disease. The appetite is impaired and the horse is dull and dejected. The pulse is increased and is rather soft; the respirations are much accelerated, being relatively much higher than the number of pulse-beats. In many severe cases indeed they are as numerous as the pulse, and may even exceed it in number.

Physical Signs.—Generally there is no alteration in percussion in bronchitis, though there may be dulness over portions of the chest where the lung is collapsed, owing to obstruction to the passage of air in inspiration by inspissated mucus, and also when pneumonia or other complications are present. In some instances of acute bronchitis attended with much secretion, the percussion note is more resonant than usual, owing to distension of the lung-tissue with air. This condition sometimes proceeds to actual emphysema. The breathing-sounds are coarse and noisy.

In the early stages, when the large bronchi are specially affected, loud, sonorous rhonchi may be heard over the anterior part of the chest, and also behind the scapula, at the upper and middle thirds of the chest. If the smaller ramifications be involved, sibilant râles are heard; they are of higher pitch, and wheezing and hissing in character. The milder forms of bronchitis yield no physical signs of importance.

As the disease progresses, there is secretion of viscid mucus from the bronchial mucous membrane, and the sounds in consequence become moist, being modified by the passing of the air through the bubbles of mucus. In the large bronchi, where the sonorous rhonchi were heard, large crepitations or mucous râles, as they are sometimes called, are now audible in their stead. In the smaller tubes lesser crepitant sounds or smart sibilant râles are heard.

In cases where the deeper and more sonorous sounds are in excess of the high-pitched sibilant râles, the disease is mainly confined to the large bronchi, and the smaller ramifications are entirely free. The prognosis in such cases is more favourable.

When the smaller bronchi are especially affected, the expirations are much prolonged, and the prognosis is more serious.

In some cases one or several bronchi may be blocked up, and thus portions of the lung may collapse, and consolidation, atrophy, and pulmonary emphysema may be induced.

As the disease progresses there is expectoration of a scanty, ropy, tenacious mucus. The discharge escapes to some extent through the nose, but the greater part passes into the mouth, and is swallowed. In the later stages, however, a profuse discharge escapes through the nostrils. The cough becomes more violent and frequent than at first, but gradually becomes less severe as the secreted mucus becomes thinner and clearer, and finally disappears.

Bronchitis of the larger tubes is not generally a fatal disease; but when affecting the smaller bronchial ramifications and pulmonary vesicles, especially if there be profuse discharge of yellowish matter, which blocks up and occludes the small tubes and air-cells, the prognosis is very serious.

Secondary Bronchitis.—Is sometimes met with in rheumatism, glanders, 'and in young horses suffering from scrofulous arthritis it is a common complication, and is here found in conjunction with pulmonary embolism' (Robertson).

In these cases the bronchial symptoms are usually manifested during the progress of the primary disease.

Mechanical Bronchitis.—The symptoms of this form of bronchitis vary much with the nature of the cause, and are similar to those of acute catarrhal bronchitis. Mechanical bronchitis is induced by some irritant in contact with the lining membrane of the tubes. The irritating agent may be gaseous, as, for instance, smoke from burning buildings or acrid fumes; or it may be fluid or solid, as, for instance, food or other matters finding their way into the air-tubes. Mechanical irritation in some instances causes the condition known as plastic bronchitis, in which laminated fibrinous casts are formed in the air-tubes, and block up the lumina, thus inducing serious pulmonary mischief.

A seven-years-old cart mare, which was expected to be near foaling, was left in a loose-box by the owner for a few hours. It was subsequently observed that an old paraffin lamp which had unwisely been left in the stable exploded. The owner, living at some distance from the stable, did not know that anything was going wrong. When, however, he did return, he found that the place was full of smoke. After a time, by dint of his efforts, the mare was removed, though only with difficulty. Mr. J. B. Gresswell arrived about four hours after the accident. The pulse of the mare was found to be well-nigh imperceptible, and her respirations were of a laboured character, and occasioned her much pain. They were, however, accompanied by a loud roaring sound. Death appearing to be imminent, and apparently unavoidable if no help could be given to enable the poor animal to breathe, the operation of tracheotomy was performed. When this was done, it was observed with feelings of surprise that there was a complete cast of coagulated yellow fibrinous exudation very nearly filling the cavity of the trachea. This cast was extricated without difficulty. Casts from the bronchi, together with froth, were also coughed up. In the nasal cavity there was a similar effusion. Immediately relief was obtained. Alcoholic stimulants were given; but unfortunately it turned out to be the case that, in spite of all the care which was bestowed upon this animal, her life could not be saved, though death was considerably postponed.

Morbid Anatomy of Bronchitis.—Inflammation of the bronchial tubes is attended with changes in the epithelial covering, glandular secretions, and in the subjacent tissues.

The mucous membrane is congested, sometimes intensely so, and undergoes more or less infiltration and thickening. It may acquire a granular aspect and soft pulpy consistence. The inflammation may be limited to the surface of the mucous membrane, but often pervades the sub-mucous tissues, in some cases involving the whole thickness of the bronchial walls, and leading to infiltration and induration of the connective-tissue surrounding them.

In some instances the inflammatory process ends in ulceration, and ulcerated patches of varying size may be observed after death.

When the small tubes are especially involved, the thickening of the mucous membrane encroaches more seriously on the channels of the affected tubes, and their secretions tend to accumulate in them, and block up their lumina entirely.

In cases where the secretion is abundant or viscid, diffuse or circumscribed patches of collapsed or condensed lung tissue of varying extent are of frequent occurrence.

This condition (atelectasis) results from the plugging of the bronchi with inspissated secretion or pus. These patches may be seen after death on the surface of the lung, as depressed areas of a dark violet hue, the surrounding parts being of a light pink colour, and either healthy or emphysematous.

The collapsed portions are less crepitant than normal lung, but not so much as hepatized lung, and they resemble fœtal lung, sinking slowly in water.

On cutting into the lungs, the large and small tubes, and sometimes the trachea, contain a quantity of secretion. This condition, as well as the collapse, is usually limited to the anterior lobes of the lung, and rarely affects the large lobules except by extension. The fluid in the tubes in the earlier stage, after that of arrested secretion, is thin and serous, but afterwards becomes thick and yellow. In the trachea it is frothy, more or less, and is abundant in the small tubes, from which yellow matter may be expressed.

If a portion of the collapsed tissue be cut into, opaque serous blood-stained fluid, sometimes intermingled with purulent secretion, exudes from the cut surface. After a time, the collapsed lung-tissue becomes atrophied, and replaced by fibrous material, and compensatory vesicular emphysema of the neighbouring lung-tissue is developed.

Pulmonary collapse is more generally met with in cases of secondary bronchitis and where the animal is in a very debilitated condition.

In all cases of bronchitis the bronchial glands are enlarged, and become more or less friable, and in the later stages still larger, owing to the accumulation of inflammatory products.

At an early stage in acute bronchitis the epithelium of the tubes is shed, and is not reproduced until after subsidence of inflammation, and the mucous membrane is thus left in an exposed condition. This shedding of the epithelium is probably due to infiltration of the basement membrane of the tubes. Bronchitis may end fatally by absorption of putrescent catarrhal products, by gangrene of the collapsed lung, or by sudden and copious effusion into the bronchi.

Treatment of Bronchitis.—The horse should be warmly clad, and placed in a well-ventilated loose box, and the diet should be liberal, nutritious and laxative.

It very rarely happens that we see a case of bronchitis in its earliest stage, in which anodynes, as, for instance, opium in moderate doses, are likely to be efficacious in reducing the irritation. After the early stage is passed, it is our object to promote the natural course of the inflammation, as we can no longer expect to cut short the attack. With this object in view the animal should be made to inhale hot-water vapour, which may be medicated with camphor or carbolic acid. In all cases of acute bronchitis, inhalation is of the greatest importance, but especially when the discharge is very profuse, is it of special efficacy in promoting the discharge from the bronchial tubes. If there be any laryngeal inflammation, stimulating embrocations, as, for instance, compound camphor liniment, should be applied externally. If the bowels are inactive, enemas should be administered, and if they still continue very constipated, a dose of linseed oil may be given.

A draught, made up of three ounces of solution of acetate of ammonium, half an ounce of nitric ether, one drachm of camphor, and half an ounce of tincture of squills, may be given three times daily, in eight ounces of water.

In cases where the small tubes are much affected, blisters or stimulating liniments may be applied with advantage to the sides of the chest.

Where the cough is troublesome after the abatement of the acute symptoms, a draught of camphor and hyoscyamus, with a small dose of morphia, may be administered twice daily.

In the later stages, if there be much debility, vegetable and mineral tonics, as, for instance, sulphate and carbonate of iron, quinine, nux vomica, and gentian, are indicated, and if there be still much cough, camphor may be added.

Chronic Bronchitis.—Chronic bronchitis is met with in the horse either as a sequel of the acute form or as an independent disease.

It differs from the acute form in its slower progress, and in its symptoms being less severe, and is characterized by a persistent hard sonorous cough, and by the absence of febrile manifestations, and, moreover, the matter expectorated is rarely of that viscid cellular nature characteristic of acute bronchitis.

The sounds heard on listening to the chest are somewhat similar to those of the former, and the respiration is almost invariably embarrassed, especially when the horse is undergoing any severe exertion.

In some instances an attack of acute bronchitis may supervene on the chronic disease from very slight causes.

Chronic bronchitis seems to be in a great measure due to thickening of the walls of the small bronchial tubes, narrowing and constricting their lumina.

In many instances this disease causes gradual loss of flesh, diminution of appetite, and general debility. When it occurs as an independent affection it is generally gradual in its onset and development, and of a very persistent nature when once established.

Treatment.—The diet should be liberal and nutritious, Rest is not necessary, though severe exertion should be prohibited. The remedies recommended in the acute form may be with advantage tried in the more persistent and chronic form of the malady.

Camphor, squills, hyoscyamus, digitalis, morphia, extract of belladonna, and hydrocyanic acid are recommended, and should be followed up by the administration of mineral or vegetable tonics or both. Among the latter, nux vomica, quinine, iron, and arsenic are well worthy of trial.

DISEASES OF THE LUNGS.

CONGESTION OF THE LUNGS.

Synonyms.—Pulmonary congestion. Pulmonary apoplexy.

Definition.—Congestion of the lungs may be said to be a hyperæmic condition of the lungs resulting from an engorgement of the pulmonary vessels with blood.

General Account.—Congestion of the lungs is one of the most important of the numerous diseases to which the horse is liable. It is therefore highly essential that our readers should be furnished with a clear and thorough knowledge of the distinguishing features and mode of treatment of this malady. In most instances pulmonary congestion is thoroughly amenable to early, vigorous, and judicious treatment. Congestion of the lungs is met with in the horse, not only during the progress of many diseases, such as inflammation of the lungs, feet, and bowels, injuries of the joints, affections of the heart, and some contagious fevers, but also as a distinct and independent affection. It is this latter kind of congestion which we propose to discuss, for that form of the malady which arises as a complication in other diseases is often best treated of in connection with the disease which it complicates. The kind of congestion which comes on in some forms of heart-disease is called passive congestion, and this kind may also be due to the general exhaustion which occurs in some fevers and other debilitating conditions. The kind of congestion which occurs as an independent affection is called acute or active congestion.

Acute Congestion is the more frequent of the two kinds of congestion of the lungs in the horse, and is more important and more easily recognised. When it is accompanied by bleeding from the nose in consequence of rupture of the small vessels in the lungs, it is sometimes spoken of as pulmonary apoplexy.

Acute congestion is the result of sudden exertion in an untrained condition, exhaustion, badly-ventilated stables, and various other causes which under some conditions induce this malady, but under other circumstances are provocative of bronchial or common catarrh.

Passive Congestion may be due to retarded venous circulation, as in mitral and some other cardiac diseases, or to general exhaustion, resulting in some fevers, and other debilitating affections.

When an animal in an untrained condition is suddenly called upon to perform any unusual exertion, the cardiac, pulmonary and muscular systems may not be able to respond to the increased strain put upon them. Under these circumstances—as, for instance, when an unprepared horse is suddenly put into the hunting-field—the heart's action becomes embarrassed and tumultuous, the blood accumulates in the pulmonary capillaries, and the breathing becomes more and more distressed, until, at length, he may die of suffocation, consequent on overloading and engorgement of the lungs with deoxidized blood. Under careful training the cardiac and other systems are gradually accustomed, by regular and careful exercise, to perform additional work, and their tone and vigour is enhanced, and the system responds duly to even severe strains.

Symptoms.—The symptoms of the acute forms of pulmonary congestion are in most instances of a very severe type, and the affection is specially characterized by very great dyspnœa. The horse stands with his limbs outstretched, and gasps for breath. All the available ordinary and extraordinary muscles of respiration are called into play; the nostrils open and close in quick succession, and the flanks heave to and fro with great rapidity. Cold sweats bedew the surface of the body; the extremities become icy cold, and the visible mucous membranes show by their livid hue the deoxidized state of the blood.

The pulse is much accelerated, and may reach 100-140 per minute; it is feeble, oppressed, indistinct, and becomes almost imperceptible in severe cases, and there is a tremor all over the body.

The heart's action, which is irregular and tumultuous from the first, becomes still more embarrassed; the lungs become more engorged; and the breathing still more distressed, until, at length, death results from asphyxia or suffocation. In more favourable instances, however, the engorgement subsides, the heart regains power, the circulation through the lungs is restored, and the animal soon regains its normal condition.

In some instances frothy blood is discharged through the nostrils, from rupture of the engorged capillaries of the lungs; in others, this hæmoptysis, or discharge of blood from the lungs, does not occur. Auscultation in some cases reveals abundant minute crepitation, generally diffused, but sometimes heard only over limited areas.

It is unnecessary to say much of **passive pulmonary congestion**, as this is treated of under the various diseases of which it is an accompaniment.

It will suffice to mention, that although the symptoms in these cases are less marked, yet the disease is more frequently fatal than in the acute form occurring as the result of exertion in an unfit condition to bear the strain.

Prognosis.—Is favourable, except in very severe cases.

Sequelæ.—Acute congestion of the lungs is very liable to recur for some time after apparent recovery, and is not unfrequently followed by acute inflammation of the lungs.

Morbid Anatomy.—The pathological lesions found after death from acute congestion of the lungs, are as characteristic as the symptoms during life.

The lungs are found to be of a dark purple hue, firm and crepitant, and the vessels of the pulmonary tissue are engorged with deoxidized blood of a tarry consistence. Here and there darker spots may be seen, where extravasation has occurred into the parenchyma of the lung. The appearance of the lungs resembles that of the spleen ; and the term splenification, or splenization, has thus been given to this congested condition of the pulmonary structures. The organs are more condensed and heavy than normal, but will generally float in water, thus differing from the condition which we shall shortly consider, termed hepatization, the result of inflammation of the lungs.

The lining membrane of the whole respiratory tract is congested, especially in the bronchial tubes, and is covered with frothy mucous secretion.

Both sides of the heart are filled with darkly coloured, thick, but not coagulated, blood. The right auricle and ventricle, with the large vessels in connection with them, are especially engorged.

In cases of passive congestion, associated with other diseases which have a fatal termination, the lungs are found to be more crepitant, and not so dark in colour, and there is a greater quantity of frothy mucus in the air-tubes.

Instances of death from acute congestion have not unfrequently occurred within a few days of purchase of a horse, and the lesions found after death have been ascribed by the uninformed to long-standing disease of the lungs. On some occasions the seller has, in consequence, been compelled to pay full value of the animal. And yet these very features, which were attributed to old-standing disease, are, on the contrary, the characteristic results of acute disease. Indeed, the darkly coloured friable condition of the lungs, with the tendency to putrefaction and liquidity of the pulmonary tissue, without the formation of organized exudation, so far from being the result of chronic disease, are in all cases characteristic of acuteness of attack.

Treatment.—In the treatment of acute congestion, it is imperative that the horse have a plentiful supply of pure fresh air, and strict quietude and repose should be enjoined in all cases. The body should be well rubbed with wisps of straw and afterwards warmly clad. The legs should be carefully bandaged with thick wool or flannel, having been previously rubbed with some stimulating liniment.

Internally, diffusible stimulants, as ether or alcohol in its various forms, in moderate and frequently repeated doses, are of great value in helping to restore the flagging circulation. Acetate of ammonium or nitrate of potash may with advantage be given in addition to the stimulant. From four to six fluid ounces of brandy, together with three fluid ounces of solution of acetate of ammonium, may be given at first every two hours for three times, and then every four hours for the same number of times.

Professor Williams speaks favourably of the tincture of arnica; but we have not found the efficacy of this medicine much to be relied upon in this disease.

If the symptoms are still unrelieved after this treatment, bleeding is necessary, in order to relieve the pulmonary congestion and the engorgement of the great veins and right side of the heart, and thus avert impending suffocation.

From three to four quarts of blood may be withdrawn. It is not advisable to repeat the bleeding, nor to apply mustard or other irritants to the sides of the animal, as these measures merely annoy the animal, and thus increase the respirations and enhance the dyspnœa.

Cloths wrung out from hot water may be applied closely to the chest. A dry rug should then be placed over them, and the whole should be well fastened with a surcingle. These hot cloths should be renewed at intervals of one hour and a half or two hours.

In order to guard against inflammation of the lungs, which sometimes succeeds acute congestion, as well as to prevent the recurrence of the congestion itself, careful management is required for some time after the abatement of the acute symptoms. The diet should be light and nutritious, and easily assimilable. The box in which the horse is placed should be well ventilated, but not draughty, and the body should be kept warm with clothing. Water may be allowed freely from the first onset of the disease.

PNEUMONIA, OR INFLAMMATION OF THE LUNGS.

Inflammatory processes in the lungs comprise the following three chief varieties :

1. Acute, plastic, lobar, croupous pneumonia.
2. Catarrhal, lobular or broncho-pneumonia.
3. Chronic, or interstitial pneumonia.

ACUTE PNEUMONIA is now accepted as a general disease, of which pneumonic consolidation is the prominent local lesion. There is some probability, from its clinical features, of this disease being due to a living specific germ or bacterium.

CATARRHAL PNEUMONIA is inflammation of the lung-tissue associated with and usually secondary to inflammation of the bronchial mucous membrane occurring independently or as a complication of some specific fever.

It is at first usually limited to scattered groups of air-cells, and hence is termed lobular.

INTERSTITIAL PNEUMONIA.—Probably never occurs as a primary and independent affection. In all cases it is probably the sequel of some more acute inflammation of the pulmonary or bronchial tissues, or of the pleura.

It seems very doubtful if interstitial pneumonia ever does occur in the horse or not. If the fever of pneumonia does not abate within two or three days or so, the malady usually proceeds to gangrene of the lungs, which is a rather common kind of the unfavourable kinds of termination of pneumonia in the case of the horse.

On the other hand, this form of pneumonia is of frequent occurrence in the ox, in which animal the interlobular tissue separating the lobules from one another is very well marked.

ETIOLOGY OF PNEUMONIA.—The usual exciting causes of pneumonia are sudden chills, exposure to wet and cold, especially after severe exertion or fatigue, and confinement in draughty or foul and badly ventilated stables. Pneumonia is especially prevalent during spring and autumn, when sudden changes in the atmospheric conditions are of frequent occurrence. Congestion of the lungs, and also previous inflammation of these organs, are both predisposing causes of pneumonia.

Pneumonia may also be induced by irritating gases, by the smoke of burning straw or wood, or other materials, by medicines, especially such irritants as ammonia, and by any foreign bodies which find their way into the lungs. It may result from injury to the lung through wounds in the chest-walls, or by fractured ribs penetrating into the lung-tissue; but pneumonia from these causes is not of such frequent occurrence as might be anticipated.

Pneumonia is met with in some specific fevers, as influenza, purpura, anthrax, and some others.

In pyæmia and glanders it is sometimes developed as the result of infecting material carried to the lungs.

Lastly, catarrh of the ordinary type, when neglected or treated carelessly, often terminates in secondary pneumonia by spreading of the inflammation downwards into the pulmonary vesicles.

PATHOLOGICAL CHANGES IN PNEUMONIA.—Inflammation of the lungs generally commences in the inferior portions, and invades the tissues from below upwards (Williams), and in all cases the small bronchial tubes are more or less involved in the process.

The pneumonia process not unfrequently involves both lungs, especially when associated with or preceded by bronchial inflammation, but far more often it affects one side only, the right side being oftener involved than the left.

1. PATHOLOGICAL CHANGES IN ACUTE PNEUMONIA.—The local changes in acute pneumonia consist in intense inflammatory hyperæmia of the lungs, and in the exudation of a large quantity of coagulable material into the tissue.

Acute inflammation of the lungs is termed croupous, from its resemblance to the pathological changes resulting in croup.

It is also termed lobar, because it almost always invades a large part of the lung.

There are three stages in this inflammatory process, but it must not be imagined that each one occurs simultaneously throughout the whole of the affected portion of the lung. On the contrary, the changes proceed irregularly, and while one portion is in the second stage another may be in the third, thus accounting for the marbled appearance of consolidated lung (Green).

The stages are firstly that of **engorgement**, secondly, that of **red hepatization**, and thirdly, that of **grey hepatization**.

In the first stage the lung becomes very vascular, and the changes in the vessels and circulation are such as already mentioned under 'Inflammation.' The absolute weight and specific gravity of the lungs are increased, their elasticity is diminished, and they are less crepitant and more friable than normally. They are of a dark red colour, and pit on pressure, and the cut surface yields a red, frothy, tenacious, viscid liquid.

In the second stage, that of red hepatization, there is exudation of liquor sanguinis and migration of blood-cells into the pulmonary tissue. The exuded liquids coagulate in the vesicles and terminal bronchioles, and the coagulum contains many white and some red blood-cells.

The lung is of a dark reddish hue, often passing into grey. It is much heavier than in the first stage, and is increased in size, so as to be often marked by the ribs.

It is quite solid, sinks in water, and cannot be artificially inflated ; does not crepitate under the fingers, and is very friable, breaking down readily with a soft fracture. The cut surface has a distinctly granular appearance, seen especially when the lung-tissue is torn. This appearance is due to the coagulated matter which plugs up the alveoli.

During this stage there appears to be but little alteration in the walls of the vesicles, or in the epithelium lining them ; the latter, however, is usually swollen and granular, and the alveolar walls often have a few leucocytes adhering to them. The pleura covering the solid lung is always more or less inflamed, and is opaque and coated with an exudation of lymph.

In the third stage, or that of grey hepatization, there is continuance of the emigration of the white cells, which escape from the vessels and gradually accumulate in the pulmonary alveoli. The epithelial cells lining the alveolar walls become more swollen and granular, and their air-vesicles become filled with cells, so that the fibrous exudation is no longer visible as an independent material, as in the second stage.

The cells soon undergo rapid fatty changes, and the fibrinous material breaks down. Thus the alveoli as usually seen are filled with granular elements, and their walls, though usually unaltered, may be partly disintegrated. The weight, density, and friability of the lung now become greater than in the stage of red hepatization, although the granular aspect of the cut surface is much less marked.

The lung-tissue is soft and pulpy, and a purulent fluid exudes from the cut surface.

The lung itself changes in colour from a dark red-brown to a grey or yellowish-white.

Terminations of Acute Pulmonary Inflammation:—

(A.) Resolution.—This is by far the most common and favourable termination of croupous pneumonia.

(B.) Abscess.—This is a rare termination. When one or more abscesses are formed they may discharge themselves by the air-tubes, or may undergo caseous or calcareous degeneration.

(C.) Gangrene.—If the case terminates unfavourably, it will probably be in gangrene. It is due to extensive formation of coagula in the pulmonary and bronchial vessels, together with considerable hæmorrhage into the pulmonary tissue, and is predisposed to by mal-hygienic conditions to which the animal may have been exposed.

(D.) Chronic Pneumonia.—If the inflammation do not subside, and the exuded liquid become absorbed, the alveolar walls gradually become involved, and thickened by fibronucleated growth.

2. PATHOLOGICAL CHANGES IN CATARRHAL OR BRONCHO-PNEUMONIA.—The inflammation of the pulmonary tissue is in this form always associated with catarrh of the bronchi.

Broncho-pneumonia may be caused firstly by the collapse of the lung-tissues from inflammation of the bronchial mucous membrane; secondly, by direct extension of the inflammation from the bronchi into the air-cells; and lastly, the inflammation may originate in the air-vesicles themselves before the bronchi are attacked. In catarrhal pneumonia, the inflammatory products which fill the alveoli consist very largely of cells derived from the epithelium of the alveoli and from the bronchial mucous membrane.

Exudation and emigration play a much less prominent part in the process than they do in croupous pneumonia.

This form has been termed catarrhal pneumonia, from the preponderance of epithelial products, and from the association of the pulmonary with the bronchial inflammation.

Resolution is less readily effected in broncho-pneumonia than in croupous pneumonia, and is sometimes so much prolonged that thickening of the bronchi and alveolar walls remain.

3. PATHOLOGICAL CHANGES IN INTERSTITIAL OR CHRONIC PNEUMONIA.—This form, like all other chronic inflammations, is characterized by gradual increase in the connective-tissues of the organs, leading to induration of the textures and obliteration of the alveolar cavities. It is often associated with catarrh and dilatation of the bronchi, and sometimes with ulceration of the bronchial walls.

The thickening of the connective-tissue has been observed in the pneumonia of glanders, in which the exuded materials break down into a thin purulent fluid.

SYMPTOMS AND COURSE OF PNEUMONIA.—Inflammation of the lungs in the horse is mostly associated with bronchitis and pleurisy, though uncomplicated cases of true acute pneumonia do sometimes occur.

In many instances, the first manifestation of this disease is the catarrh which accompanies or precedes the inflammation of the lungs. Pneumonia is sometimes ushered in with a severe rigor, succeeded by a hot stage. The pulse is accelerated but very variable, and numbers usually from 90 to 100 beats per minute. The artery is hard and full at the outset, or it may be soft and full. In some instances it is irregular, intermittent, or dicrotic.

The temperature is raised and may read from 103° F. to as high as 106°. The skin and extremities are cold, and the visible mucous membranes are red and injected. The bowels are constipated, and the fæces coated with mucus.

The horse loses his appetite, and wanders to and fro in his box in a dull, dejected manner, showing no inclination to lie down.

If the case be complicated with pleurisy, the breathing is more painful and abdominal; but in pneumonia not associated with pleurisy there are no signs of pain.

There may be dull dry cough, but there is seldom much expectoration, though rusty or blood-stained, more or less viscid tenacious matter, is sometimes discharged through the nostrils in croupous pneumonia, whereas in bronchitis and catarrhal pneumonia the discharge is more or less purulent. The urine is lessened in amount, and there is excess of urea and diminution of salines, especially chlorides, which probably, as in man, reappear in the urine during convalescence in full amount.

As the inflammation progresses, the respirations, which at first were but slightly accelerated, gradually become more so, until the crisis, when they are much quickened. The breathing is also sometimes much accelerated in the congestive paroxysms, which are not at all infrequent during the progress of the malady. The febrile symptoms extend over a period of several days, or even longer, and then subside.

Some authorities describe the temperature as gradually subsiding; but we have noted very many instances of acute pneumonia where the *defervescence* of the fever has occurred suddenly, the temperature falling by *crisis* from 105° or more to near the normal in the course of two or three hours. The pulse falls, the appetite returns, the secretion of urine is again abundant, and the animal is soon convalescent.

Physical Signs.—Percussion reveals increased dulness in the second and third stages of ordinary acute pneumonia; there is, however, usually no impairment of resonance in the first stage.

In the early stages the respiratory murmur heard in auscultating the chest is harsher and louder than normally; and abundant fine crepitations are heard during inspiration, and sometimes also in expiration.

In the second stage the respiratory murmur is replaced by the *very characteristic tubular or bronchial breathing.* In some instances there is a total absence of breathing sounds in this stage, and the fine crepitations are not heard.

In the third stage of an ordinary attack ending in resolution, the bronchial breathing gradually gives place to crepitation of a moist coarse character, termed redux, or secondary crepitation, and this gradually passes into the ordinary bronchitic râles.

Pleural friction may be heard in addition to the sounds due to the pneumonia, when this disease is complicated with inflammation of the pleural membranes.

Acute pneumonia, especially when associated with bronchitis, is said to be sometimes complicated with laminitis, or inflammation of the vascular structures of the feet.

When pulmonary inflammation occurs as a secondary affection, especially when associated with some specific fever, or when the animal has been subjected to malhygienic and debilitating conditions, the attack is very apt to assume the adynamic or asthenic type, and is more likely to end in breaking down of the pulmonary tissues than in resolution.

Under such circumstances the pulmonary inflammation is more of the catarrhal or lobular type, which is chiefly characterized by filling of the alveoli with cells derived from the epithelium lining them, and by the fact that exudation and emigration play a much less prominent part in the process than they do in croupous pneumonia. Catarrhal pneumonia terminates by gradual defervescence of the febrile symptoms, or lysis, as it is termed.

Prognosis.—Is favourable in most instances. Pneumonia may prove fatal from the intensity of the fever in the early stages, and also during the stage of hepatization, from suffocation occurring as the result of the pathological changes. In double pneumonia, or inflammation of both lungs, the prognosis must be very guarded, as it is far more frequently attended with a fatal result than is the single form.

Secondary pneumonia (*cœteris paribus*) is more serious than inflammation of the lungs occurring as a primary affection.

Treatment.—In the treatment of pneumonia, concerning which there is so much divergence of opinion, it is above all things necessary to consider the form of pulmonary inflammation in each individual case; the constitution of our patient; and, finally, the condition, work, diet, and hygienic surroundings under which he has been placed. The animal should be placed in a well-ventilated, but not draughty, loose box. This is one of the first essentials in the treatment of pneumonia, as impure air, containing organic germs, is apt to cause the inflammation to take on a suppurative form. If possible, the temperature of the box should be kept at 70° to 75° F.

The body should be clothed with rugs, and should be gently rubbed down occasionally with wisps of hay.

Bleeding should be practised only under exceptional circumstances, as, for instance, when the animal has been having a large allowance of corn—for example, up to a stone or a stone and a half per day. In treating heavy draught horses kept in very high condition, as many of the agricultural and dray horses are, and also plethoric horses of other breeds, when the dyspnœa, or difficulty of breathing, is great, and the fever very high, it is our custom to remove from four to six quarts of blood. Under no circumstances do we repeat the operation.

Though practised formerly, and at the present day by some in almost all cases of acute lobar pneumonia, bleeding is not only of no advantage in many cases, but even positively harmful, and delays the convalescence of the horse, even though it may seem to relieve the dyspnœa for a time. In secondary pneumonia *bleeding should never be practised.*

We may allow the horse as much tepid or cold water, if he prefer it, as he will take; and with this object should leave a moderate supply by him.

The diet should be laxative and nutritious: bran-mashes, oatmeal gruel, linseed gruel, hay in moderate quantity, and roots or grass may be allowed. After the subsidence of the fever, stronger nutritious diet should be substituted.

During the fever, a draught containing five minims of Fleming's tincture of aconite, four ounces of liquor ammoniæ acetatis, one ounce of nitric ether, and two drachms of nitrate of potash, may be given every four hours, until the acute symptoms begin to abate. We entirely concur with those authorities who hold that tartar emetic, digitalis and calomel are of no effect in curtailing the duration of the pyrexia, and that opium should only be given when the pneumonia is associated with pleuritic pain. Owing to the irritable condition of the bowels in pneumonia, active purgatives should never be given. If there be great constipation, enemas or small doses of oil may be given.

In the later stages, when the pulse is weak and dicrotous, and from the earliest stages when the inflammation is of the adynamic or asthenic type, stimulants are indicated.

Six or eight ounces of whisky may be administered three times daily, and should be persevered with if it prove beneficial. If, on the contrary, the breathing becomes still more distressed, the treatment should be discontinued immediately. Bromide of ammonium and potassium are recommended by Williams as useful in moderate doses, having a calmative effect.

During convalescence vegetable and mineral tonics are indicated.

Finally, with regard to local applications:

When the extremities are icy cold they may be rubbed with stimulating applications of a non-irritating kind.

Woollen cloths wrung out from hot water may be applied with great advantage around the chest, and should be renewed every two hours, or oftener, so long as the acute symptoms last.*

The indiscriminate use of blisters and sinapisms to the chest is a practice to be deprecated But we are of opinion that in many cases of pneumonia decided advantage is to be obtained by vesication.

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* Great care is necessary in the mode of application of hot rugs, and several methods have been suggested. In the first place, the hot pack should be closely applied, so that no cold air can pass between the rugs and the skin. In the next place, the temperature of the rugs should be as high as the animal will bear. A good method of applying this treatment is to obtain a piece of felt about an inch thick and a foot and a half wide, fitted with straps. After being well wrung out from hot water and applied closely to the chest, a waterproof lined with flannel should be strapped round the felt. A simpler method is the application of an ordinary blanket, folded three or four times, over which is placed a dry rug, the whole being fastened with a surcingle or plough line. The best method of application is to have about six layers of horse-rugging (thick flannel) sewn together and fitted with straps, and steeped in hot water and wrung out and strapped round, and then the waterproof sheeting strapped over it.

ASTHMA AND BROKEN WIND.

ASTHMA.—Definition.—Asthma is a morbid condition characterized by paroxysms of dyspnœa, probably depending upon spasm of the circular muscles of the bronchi, and often accompanied by a wheezing noise in the respiration.

Etiology and Nature.—The causes of asthma are heredity, direct and reflex nervous irritation, fatigue, overwork, and debility. Asthma bears a close resemblance in many points to broken wind, and appears to be due to spasm of the circular muscle-fibres of the bronchial tubes. If prolonged, asthma frequently terminates in that paralytic condition of the bronchial tubes, and in those changes in the structure of the pulmonary-tissue, constituting broken wind.

The latter condition may be aggravated by further spasmodic attacks, which gradually involve more of the bronchial tubes.

Asthma is by many regarded as an early stage of broken wind, but as many cases undoubtedly recover without passing into the more serious condition, we have thought it advisable to consider it separately.

Symptoms.—Asthma is characterized by sudden spasmodic dyspnœa, which resembles that of broken wind in that the inspiration is easier than the expiration. The latter is usually of a jerky character, but has a less distinct double action than in broken wind.

In asthma the wheezing is more distinct; there is more exhaustion with less cough, which is not so hollow as in broken wind, but is short, quick, or suppressed. The suddenness of the paroxysms, their true spasmodic nature, their severity, their sudden accession and decline, and unaccountable disappearance, are marked features of asthma.

The febrile disturbance is severe when the disease is fully developed, and the chest is fixed, as it were, and there is increased movement of the abdominal muscles. When the cough is severe, small pellets of mucus are discharged through the nostrils.

If the chest be auscultated, the wheezing noise is very distinctly audible in the anterior and lateral regions. The spasms may last a few days, or may extend over several weeks, and then disappear or pass imperceptibly into broken wind.

Treatment.—The diet should be of a laxative nature, and if the cough is very severe the sides of the chest may be blistered with great advantage.

The drugs of most value as internal remedies are digitalis, amyl nitrite, belladonna, lobelia, chloral hydrate, opium, and the bromides of potassium and ammonium.

Iodide of ethyl, used as an inhalation, is well worthy of trial.

BROKEN WIND.—**Definition.**—Is a nervous, inflammatory disease, characterized by difficult and spasmodic breathing, the inspiratory act being easily performed, the expiratory being very prolonged, and accomplished by two apparent efforts.

The dyspnœa is constant, and though marked by remissions and exacerbations, is not truly intermittent, as in asthma, and the cough, spoken of as the 'broken-winded cough,' is short and nervous.

Indigestion, flatulence and cardiac disease sometimes aggravate the dyspnœa.

Nature and Etiology.—The exact nature of broken wind is still a disputed point.

According to Professor Gamgee, broken wind is at first a purely nervous affection, dependent on an unhealthy condition of the digestive organs, and the pathological lesions are to be attributed to the effects of the nervous disease, which especially involves the pneumogastrics. He further attributes the condition of the digestive organs themselves to improper dieting, or to constitutional predisposition to indigestion and tympanites.

With this view we entirely agree.

According to others, the manifestations of the disease are held to be *primarily* due to emphysema, and other structural changes in the lungs. Now, although pulmonary emphysema together with alteration in the tissue of the air-cells are found in very many instances of broken wind, it must nevertheless be borne in mind that these changes are by no means always present, for in some cases there is no evidence of emphysema or other structural pulmonary lesion after death.

And again, it is noteworthy that pulmonary emphysema, especially of the vesicular form, has been found in many horses which have not at any time shown symptoms of broken wind.

Now, therefore, although it is probable that the amount of respiratory derangement bears a close relation to the extent of the emphysematous condition of the lungs, we can nevertheless only regard these lesions as the *occasional* result of some other diseased condition, and in no measure as the prime cause.

Regarding broken wind as dependent on disturbed innervation, traceable to derangement of the digestive system, the phenomena of this disease, and the variable pathological lesions found, may be readily accounted for.

Between the sub-epithelial mucosa and the submucosa of the small bronchial tubes there is a continuous layer of circular non-striped muscular tissue. This layer is especially conspicuous and important in the smaller microscopic bronchi (Klein), and by contracting aids the expulsion of tidal air from the lungs in expiration.

This muscle in broken wind is first spasmodically contracted, and then afterwards becomes paralyzed, and undergoes degenerative changes. This is owing to the irritation set up by indigestible food acting on the gastric branches of the pneumogastrics, and reflected through the pulmonary branches of the same nerves. This spasmodic contraction or paralysis arrests both the respiratory acts, especially the expiration, which becomes double, and requires a double contraction of the abdominal muscles to force out the air from the distended air-cells and now inactive bronchial tubes.

Round-chested horses sometimes become broken-winded without any apparent cause, and difficulty in expiration may be attributed in such cases to the limitation of the thoracic contraction. It will easily be seen that when the shape of the chest is round the thoracic movements are more limited, and the horse will in consequence not be able to take deep inspirations or make strong expiratory efforts.

The nervous or functional derangement of the bronchial tubes and air-vesicles is soon succeeded by structural changes. The latter become inflated, and thus the circulation in the capillary blood-vessels is impeded, and the nutrition of the bronchial mucous membrane and muscles, and the walls of the vesicles themselves, becomes impaired (Williams).

Degeneration of these structures now follows, and the lungs become more and more emphysematous, the air-cells are dilated, their walls are stretched, and air now becomes intercalated among the connective-tissue of the lung.

In this manner vesicular and interlobular emphysema may frequently be produced. The right side of the heart may become hypertrophied and dilated in consequence of these changes in the lung structure.

The dyspnœa of broken wind seems to result from the emphysematous condition of the lung, as well as from general impairment of the contractile power of the pulmonary organs.

Having now reviewed the proximate causes of broken wind, we may now consider the more remote causes.

They are:

(1.) **Heredity.**—The offspring may inherit the same bodily conformation and temperament as their parents, and thus be more liable to become similarly affected.

(2.) **Dietetic.**—Defective dietetic conditions are largely responsible for the production of broken wind. As the diet of the coarser breed is frequently innutritious and bulky, and the animals often worked after a heavy meal with full allowance of water, they are more frequently affected with this disease than better bred horses which are more carefully attended to.

Professor Robertson says that chopped hay is especially liable to induce broken wind, and has noticed in some districts that while the agricultural horses were fed on oats, with hay or oat straw, the fodder being given in full supply, broken wind was unknown, but that when the extensive use of chopped hay and oat-straw was adopted, this disease became comparatively common.

(3.) **Changes caused by Previous Diseases.**—Those changes in the lung tissue which arrest the contractile power and action of pulmonary air-tubes may cause broken wind.

Symptoms.—The symptoms in confirmed cases of broken wind are unmistakable, but when not so fully developed the disease may be occasionally overlooked.

The inspiratory movement is performed rather quickly and with ease. The expiratory movement is much prolonged, difficult, and accomplished by two apparent efforts. It begins by a rapid contraction and upward movement of the posterior walls of the abdomen, and is suddenly stayed before the act is completed, and then continued slowly by an upward and forward movement of the abdominal muscles.

The cough of broken wind is characteristic, being short, of little force, and suppressed, and seems to be ejaculated with a kind of grunt through the upper part of the trachea (Blain). When the animal is in fair condition, the cough generally occurs only at long intervals, and rarely in paroxysms; but at the commencement of the disease, and when the horse is excited from any cause, or during exercise, it is apt to break out in paroxysms.

In many instances cough is one of the first indications of broken wind.

After feeding, the symptoms are more severe, and they are liable to exacerbations from extremes of heat and cold, and other atmospheric changes.

The chest is rounder than it should be, and the thoracic movements are much impaired, while the movements of the abdomen are violently put into action during a paroxysm of cough.

In well-developed cases the loud sonorous wheezing noise may be distinctly heard while near the animal. If the chest be carefully auscultated, rhonchus and sibilus will be audible all over the chest, but the sounds vary much in character, even in the same animal, at different times.

The respiratory murmur is diminished or absent. In the inspiration a 'cooing rhonchus or friction sound' is heard; whereas a weak crepitus is audible in the prolonged expiration. Percussion reveals increased resonance in various parts of the chest. In confirmed cases the digestive organs are weak and easily deranged, the bowels are tympanitic, and borborygmi are frequent. The horse is debilitated and unthrifty, and the coat is often harsh, dry, and scurfy. When worked, he is easily fatigued, and perspires easily, and the bowels are generally loose.

Morbid Anatomy.—The pathological lesions found after death, which is in most cases due to some other disease or to accident, are very variable in character.

The organs in which the changes are most frequently met with are the lungs, heart, stomach, and intestines.

If death occurs during the early stages, no marked change may be found anywhere, though in some instances the lungs are slightly paler, and have greater buoyancy when floated in water than normal pulmonary tissue.

When the disease has existed for a long time, the usual pathological lesions which may be found in the lungs are interlobular and vesicular emphysema, thickening of the walls of the small bronchi, hypertrophy of the mucous membrane of the larger tubes, and pallor of the pulmonary parenchyma.

Vesicular emphysema consists in permanent dilatation and enlargement of the infundibula and air-vesicles in larger or smaller areas of the lungs. As the process continues, communications are established between the adjacent groups of air-vesicles by atrophy and degeneration of their walls.

In this form of emphysema little vesicles containing air may be seen beneath the surface of the serous covering of the lung.

Interlobular emphysema is due to distension with air of the connective-tissue between the separate vesicles and the air-tubes.

In most cases of broken wind the heart, especially the right side, is hypertrophied and dilated, and is heavier and more bulky than normally.

The stomach is much dilated, and its walls stretched, and in old-standing cases similar changes may sometimes be found in the intestinal tract.

Treatment.—Above all things, it is essential that the diet should be carefully attended to. The food should be nutritious and digestible, and in moderate quantity, and the water-supply should be well regulated. The symptoms of broken wind may be ameliorated by all remedies which increase the general condition and improve the digestive powers.

Arsenic, in the form of Fowler's solution, which may be given in the drinking-water, is especially recommended. Nux vomica and vegetable bitters may be given in addition.

The arsenic may at first be given in moderate doses twice daily for two or three weeks, and then once a day for a similar period, and then finally once every alternate day.

Purgatives in moderate doses, when occasionally administered, are beneficial in regulating the action of the bowels.

It is well known that some unprincipled persons adopt special measures in order to pass off a broken-winded animal for sale.

With this object they allow little or no food and water, and give the animal a sharp trot, in order that the bowels may be emptied.

They administer also various drugs, such as digitalis, opium, and other agents which have a temporary sedative effect, and in this manner have deceived many persons.

PLEURITIS, OF INFLAMMATION OF THE PLEURAL MEMBRANE.

Definition.—Pleurisy is inflammation of the visceral and parietal layer of the pleural membrane, and is termed primary (idiopathic), or secondary when depending upon some other disease of primary or general nature.

Etiology.—Pleurisy is due to

(1.) *Extension of the inflammatory action to the pleura, from contiguous or neighbouring parts.*

For example, pleurisy is frequently associated with, or supervenes on, pneumonia, bronchitis, and also cardiac and pericardiac diseases.

The pleural membranes are especially liable to be involved in this way when the primary disease is of an epizoötic nature.

(2.) *Irritation from injury or morbid growths.*

Wounds penetrating the thoracic walls, or fractured ribs, are apt to set up inflammation of the pleural membrane. The accumulation of fluid in the pleural sac, and the development of morbid growths in contact with the membrane, are also liable to set up pleurisy.

(3.) *Exposure to cold and damp and sudden atmospheric changes.*

(4.) *Certain enzoötic and epizoötic fevers and other constitutional diseases.*

For example, pleurisy is a frequent concomitant of some of the specific fevers, as, for example, influenza, and of constitutional diseases, as rheumatism, suppurative phlebitis and pyæmia.

Symptoms.—The fever of acute pleurisy is ushered in by a slight chill or by an actual rigor. The animal may be restless, and show signs of pain, aggravated by breathing, which, though accelerated, is performed carefully. The pain is increased when the horse is moved round, and the chest wall is very tender to pressure or when percussed, and the expression is anxious and indicative of great pain. The pulse is increased in frequency, but its ratio to the breathing is only slightly disturbed, and is hard and more incompressible than in pneumonia. The temperature is raised to 103° or 104°, the mouth is hot and dry, but the expired air is not so heated as in pneumonia.

In the inspiratory act the ribs are fixed, and in consequence of this there may be observed a furrow on the line of demarcation, called the pleuritic ridge. This extends from the bottom of the posterior part of the chest, and runs obliquely in an upward and backward direction to the anterior spine of the ilium. Cough is a frequent symptom of pleurisy. It is shorter and more painful than in pneumonia, and is attended with little or no expectoration.

If the chest be examined a friction sound, or 'dry leather creaking,' as it is sometimes termed, may be heard. This is owing to the rubbing of the two pleural surfaces together.

This sound appears as if close under the ear, and as the lung moves to and fro it is consequently double. It is not heard if the breathing cease, and the area over which it is audible may be very limited.

The friction may in many instances be felt by placing the hand over the involved area of the chest-wall. The vesicular murmur is weakened, and percussion in this dry stage reveals nothing.

The inflammation may now subside, with the effusion of very little lymph, in which case the friction sound passes away. If, on the other hand, the fluid gradually accumulates, in this case also this sound disappears, as the two roughened surfaces are separated by a layer of fluid.

When absorption of the fluid takes place, the two layers come together again, the sound is heard again, and is called 'redux friction.'

With the effusion of fluid the more active febrile symptoms and pain abate, the temperature may fall a little, the pulse is less jarring, and the pleuritic ridge less distinct.

If the effusion now accumulate in very large amount, the symptoms become more serious; the pulse is increased to 80 beats or more per minute, even to 90 or 100, and may be imperceptible; it is of smaller volume, and may be irregular in rhythm and volume. The respirations become extremely laboured, and the difficulty of breathing may be very great; the flanks heave excessively, and the nostrils are widely dilated.

This dyspnœa is to be attributed to compression of the structure of the lung by the accumulated fluid, which, if not absorbed, is spoken of as dropsy of the chest, or **hydrothorax**. There is a peculiar churning movement of the chest, which frequently points to the presence of water in the thoracic cavity.

The animal's head is generally protruded, and dropsical swellings appear in various parts. They are usually first noticed along the inferior part of the thorax, spreading along the floor of the abdomen, and may at length involve the limbs.

Prognosis.—Mild cases of pleurisy generally recover in a few days to a week. The more serious cases, however, where there is much effusion of lymph, are of longer duration, and though the prognosis is, in most cases, favourable, yet the changes in the pleural membrane, and the adhesions formed between the two layers, often continue for life.

Cases of pleurisy associated with specific influences are liable to be much protracted, or even prove fatal from the effused lymph becoming purulent. This condition is termed **empyema**.

If the febrile symptoms do not gradually begin to abate, we may reasonably suspect effusion. In this case the pulse will gradually become quicker, and the respirations more markedly disturbed.

Morbid Anatomy.—The inflammatory process commences in hyperæmia of the pleural membrane. Exudation of fluid and blood-cells into the pleural cavity soon follow.

Gradually the surfaces become opaque, roughened, and very vascular, and covered over with a fibrinous layer, whilst more or less fluid transudes into the cavity.

The exudation from the vessels forms a soft, elastic membranous or reticulated coating, enclosing many cells in its meshes.

In this way the opposed surfaces of the pleural membrane may be glued together.

The exuded liquid varies considerably in amount, and is always turbid, in this respect differing from the non-inflammatory effusions.

It contains flakes and masses of coagulated fibrin, and many cells, which in the early stages are almost entirely emigrants. There may be whole sheets of fibrin resembling yellow jelly or fat.

If now the inflammation subsides, and the effused fluid is not sufficient to prevent the two surfaces coming into contact, they may become adherent, the union being effected by the formation of connective-tissue. If, however, the inflammation is severe, or there is much effusion, organization and adhesion cannot be effected.

The presence of much fluid interferes with its own absorption by pressing upon and impeding the circulation in the blood-vessels and lymphatics, and thus the two surfaces are kept apart; but when the liquid is absorbed, the two surfaces may then grow together.

When the inflammatory action does not subside, or is of a very severe type, or depends upon some specific disease, pus may be formed and accumulate in the pleural sac. As the connective tissue becomes involved, granulation-tissue is formed, and may continue to generate pus, and discharge it into the pleural sac. The membranes become thickened, and the new tissue contracts in its organization, producing more or less retraction of the chest-wall. When the effusion has been very great, the pulmonary tissue is found much compressed, and when incised is tough, pale and dry. Between four and five gallons of serous effusion have been abstracted in some cases.

The pleura of both sides may be involved, but usually the inflammation is confined to one, more frequently the right.

Treatment.—The horse should be placed in a loose box well ventilated, but of equable temperature, and should be warmly clothed with rugs. The diet should be at first nutritious, and such as is calculated to keep the bowels in regular action. As in pneumonia, bleeding is not recommended, except under very special circumstances. When the pleuritic attack is of an acute sthenic type, and not associated with any other constitutional disease, moderate bleeding in the early stages is recommended by some eminent authorities. The removal of from four to six quarts of blood under such circumstances is said to be followed by marked benefit and relief of the acute symptoms. We, however, do not practise bleeding under any circumstances in pleurisy, unless, indeed, the attack is associated with acute inflammation of the lungs. Internally, saline febrifuges may be administered, as in pneumonia, and if the pain be great, tincture of opium may be given in addition. Fleming's tincture of aconite is a very valuable remedy in the acute stage, and may be given in five or six minim doses every four hours. In cases where the abdominal pain is great, some authorities recommend the injection of forty minims of liquor morphinæ hydrochloratis hypod. (B.P.) into the subcutaneous tissue at the point of the sternum.

Woollen cloths wrung out from hot water and applied round the chest, as in pneumonia,* are of great service in pleurisy also. They should be applied for about two hours continuously, and should be renewed four or five times daily, as long as the acute symptoms last.

If after abatement of the severe febrile symptoms the animal seems to make no progress towards recovery, but still breathes with difficulty, and the temperature remains high, stimulating liniments applied to the chest are recommended as very useful.

About four ounces of whisky, or other alcoholic liquor, may be given also under these circumstances three times daily, and if we have any reason to suspect the accumulation of liquid in the pleural sac, one drachm of potassium iodide may be given with the drinking-water two or three times a day.

In those cases where debility follows the acute symptoms, quinine and salts of iron may be given in addition to the above remedies.

When the effusion is extensive, and, although all therapeutic measures have been taken, remains unabated after three weeks or so, thus interfering seriously with the respiration, it is advisable to perform the operation of paracentesis thoracis, in order to relieve the pressure of the fluid on the lungs.

Some authorities have highly recommended cantharides in doses of three to six grains, with half a drachm of digitalis and two drachms of nitrate of potash in the form of a ball, given twice daily for a week.

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* Vide 'Treatment of Acute Pneumonia,' page 162.

But, presuming that after the administration of the therapeutic agents the effusion rather tends to increase than to become lessened in amount, we should not delay the operation. We may use the ordinary trochar and canula, or pneumatic aspirator, and should puncture the chest-wall in the eighth or ninth intercostal space at a point midway between the upper limit of the fluid and the bottom of the pleural cavity.

It is not necessary to remove all the fluid, as after the escape of a fair quantity the rest may become absorbed by the vessels, through which the circulation again passes freely.

If necessary, the operation may be repeated in a couple of days.

Tonics with nitric ether may be given after the operation, and the bowels should be regulated by laxative diet, which should be of a nutritious character, and if necessary, mild doses of oil, or other aperient, may be given in addition.

CHAPTER VI.

DISEASES OF THE CIRCULATORY SYSTEM.

PHYSICAL EXAMINATION OF THE HEART AND PERICARDIUM.

Diseases of the heart and pericardium, though of rare occurrence in the horse as compared with man, are nevertheless of great importance, and are by no means of unfrequent occurrence. In examining the heart, the methods of inspection, palpation and auscultation are adopted, as in the detection of diseases of the respiratory organs.

In the horse the heart is not so accessible for examination as in man, and in consequence 'of the ponderous shoulder closing in upon the keel-shaped thorax we are not able to distinguish the heart-sounds at different parts, and to determine the space filled by the organ, however large it may be' (Gamgee).

Thus the difficulties to be encountered in the detection of changes in the heart of the horse are far greater than in man.

We may firstly determine, in an examination of the heart, the nature of the impulse, and secondly the character of the sounds heard on listening over the cardiac area.

1. **CARDIAC IMPULSE.**—The impulse of the heart may be felt by placing the hand directly upon the left side of the chest, immediately below the elbow. It is more distinct in flat-sided and thin animals, and less so, or even imperceptible, in round-chested and fat ones. The impulse may be altered in position and area, in force, in character, and in rhythm.

(A.) *In position and area.*—It may, owing to abdominal distension, be displaced forwards and upwards, or it may, owing to collection of fluid in the pericardium or chest, be displaced upwards and laterally.

The area over which the impulse is felt is 'extended' in cardiac hypertrophy, and in adhesions of the pericardium to the chest-walls.

It is very feeble, though extended, in pericardial effusion.

(B.) *In force and character.*—The impulse is more forcible, and sometimes extended over a larger area, in most cases of hypertrophy, with dilatation and incompetence of the valves. In these cases it is rather slow and steady, and occasionally appears to be produced not only when the heart contracts, but when it commences to dilate. This latter is called diastolic impulse.

Diminished impulse indicates feebleness of the heart. This may be due to degeneration, or to weakness of the heart owing to thinning of the walls or to general disease of the system.

It is also diminished in effusion into the sac of the pericardium, and may be lessened owing to pericardial adhesions.

(C.) *In rhythm.*—May be irregular in force, at one time strong, at another weak, or it may be irregular in time or in character.

The following remarks on 'Comparative Sphygmography,' by ourselves, are taken from the *Veterinary Journal* for 1884, vol. xviii., page 410:

'There are many difficulties which beset the application of the ordinary sphygmograph to animals—by ordinary sphygmographs we mean the direct, Marey's and Dudgeon's. Most of these difficulties, however, are more or less easily surmounted, but some are apparently not so.

'Among the latter we would include the case of animals of a restless, irritable temperament; moreover, the application of Marey's direct instrument is in most cases quite out of the question.

'Of the direct instruments at present in use, we prefer Dudgeon's (made by Messrs. Arnold and Sons), but we feel that an instrument should be constructed specially adapted for application to animals, and, indeed, modifiable for application to different animals—modifiable especially in the shape and size of the button on the spring, and in the width between the bars which flank this button on either side.

'And in making the instrument we should bear in mind the sudden and apparently unprovoked movements of animals.

'We think, however, that the so-called indirect instrument is the most easily applied of the sphygmographs at present in use, and that it yields the most trustworthy records.

'Human sphygmograms are almost invariably taken from the radial artery; we prefer to take the sphygmogram of the ox from the facial or external maxillary artery, and that of the horse from the temporal artery.

'Sphygmograms of animals will be useful, we think, when they serve as faithful records of the state of the pulse, and they will be the more faithful—we mean the more interpretable—if they be taken from those arteries with whose pulsations we are most familiar.

'True, some prefer to gauge the pulse at the fetlock in the beast and at the fore-arm in the horse, but we believe that the majority direct their attention to the pulsations of the external maxillary artery in the beast, and those of the sub-maxillary of the horse (so that, taking the sphygmogram of the horse at the temporal, we take it at a point somewhat more distant from the heart than we would take the pulse).

'In interpreting the direct sphygmograms of animals we are apt, perhaps, to be somewhat misled by the interpretation of the sphygmograms of man, but we must bear in mind several points in this relation.

'Of these we would make mention of the following:

'(1) Animals supply an additional factor, viz., hair. We find it advisable, where feasible, to cut the hair close.

'(2) The skin of animals is thicker than that of man, and when the sphygmogram is taken by the direct sphygmograph, a large bulk of skin is included within the bars which stand on either side of the button of the spring.

'(3) The skin of animals is much looser, so that the sphygmogram is possibly further modified by even a duplicature of skin.

(4) The sphygmograms of man are almost invariably taken from the radial, while those of the horse we find most easily obtained from the temporal, and those of the ox from the external maxillary artery.

'Hence, in these cases, *i.e.*, in animals, the tracing is taken nearer to the centre of the circulation than it is in the case of man.

'As an illustration of the caution needed in applying the interpretation of the sphygmograms of man to those of animals, we would mention the case of dicrotism in animals, which (though it were very sensible to the finger, and though it apparently would, in the case of man, give an almost hyperdicrotous tracing) gives a tracing whose aorti notch scarcely descends to the base-line; indeed, the tracings of an ox in a state of extreme emaciation, and close upon the point of death, which we took only a short time ago, though really indicative of extreme prostration in the animal, might be read, were it man's, as one of a considerable amount of tone.

'We would conclude with an expression of a wish that sphygmography of animals were more generally practised, in order that those who have such ample opportunities might render a good service in the cause of physiological research, of pathological research, and of science.'

2. CARDIAC SOUNDS IN HEALTH AND DISEASE.—When the ear is placed over the cardiac area, two sounds are audible in health. They may be best heard by extension of the left fore-leg, and by pulling forward the humerus as far as possible.

They differ in character, and have been compared to the two syllables 'lab' and 'dup,' the first being longer and heavier (lab), the second, which follows quickly after a short interval, being shorter and sharper (dup). After the second sound follows another longer interval.

The first sound is complex, and although in part due to the closure of the auriculo-ventricular valves, other factors appear to be necessary for its normal production, such as a healthy condition of the muscular tissue of the heart and of the blood. It is heard during the first part of the contraction or systole of the heart.

The second sound is chiefly due to the closure of the semilunar valves in the aorta and pulmonary arteries, and corresponds in time to the first part of the diastole, or period of dilatation.

In investigating the heart's action in disease, we have to consider firstly the two sounds, and secondly the two intervals by which the sounds are separated. In health there is no sound audible during the intervals.

The natural sounds may be modified in disease, and fresh sounds may be heard. These fresh sounds are termed **murmurs**, and although they may replace the normal sounds, they always do something more, *i.e.*, *they always occupy part of the interval as well.* The natural sounds may be altered in intensity, in duration, in rhythm, in pitch (high-pitched and clear, or low-pitched and muffled), and finally in some cases they are absent altogether.

Murmurs may be heard when both sounds are present, or when one or both of the sounds is absent. The terms used to describe murmurs are *soft*, *blowing*, *loud*, *faint*, *harsh*, *grating* and *rasping*.

Cardiac murmurs are divided into two groups, endocardial and exocardial.

(A.) **Endocardial Murmurs.**—Murmurs in the heart are called organic when they depend upon some structural change in the heart, and inorganic when no such change exists. As the heart is continually contracting and dilating, they fall further into two groups, *systolic* and *diastolic* murmurs.

Murmurs in the heart or vessels are due to eddies set up in the blood; they are heard when a current of fluid passes through a narrow orifice into a larger space. In the heart, so long as the normal relation exists between the size of the orifices and that of the cavities of the ventricles, murmurs are not produced; but when the relation is disturbed murmurs are likely to arise.

They may depend upon dilation of the cavities into which the blood is passing, the orifices being unaltered, or to changes in the condition of the orifices, the cavities remaining natural. These conditions are usually associated. A murmur heard during the systole of the heart, called a *ventricular systolic murmur*, may be due to abnormalities in the auriculo-ventricular valves, or in the arterial orifices.

When occurring at the auriculo-ventricular orifice, the murmur is owing to the imperfect closure cf the valves during the contraction of the heart, so that some of the blood, instead of passing through the arterial orifices, passes back, or regurgitates into the auricles. In these cases it is a *murmur of regurgitation.*

When occurring at the orifice of the aorta, or pulmonary artery, the systolic murmur is due to thickening or other changes in the semilunar valves causing constriction of the orifice, and thus impeding the onflow of blood.

In these cases it is a *murmur of constriction.*

In the horse the systolic murmur is generally very loud and high-pitched, especially when associated with hypertrophy of the ventricles. It has been heard in mitral insufficiency consequent upon dilatation of the left ventricle, and also where the mitral valves are thickened or otherwise changed, and where large collections of fibrinous clots have been found among the chordæ tendinea. In disease of the tricuspid valve it has also been detected.

Murmurs heard during the diastolic period, known as *ventricular diastolic murmurs,* are likewise due either to disease of the auriculo-ventricular valves or of the arterial orifices.

When occurring at the auriculo-ventricular valves the murmur is due to the passing of the blood from the auricle into the ventricle through a constricted orifice, due to disease of the tricuspid or mitral valves. It is a *murmur of constriction.*

When occurring at the arterial orifices it is due to *regurgitation* of the blood from the aorta or pulmonary artery into the ventricles, owing to the insufficient closure of the semilunar valves.

Murmurs may be heard both during diastole and systole, in which case they are said to be double.

The usual pathological changes causing the double murmur in the horse are aortic insufficiency and mitral constriction.

(B.) **Exocardial Murmurs.**—The healthy pericardium is smooth, and thus no sound is produced when the opposed surfaces of the serous membrane come in contact.

When, however, the pericardium is roughened, as it is when inflamed, a sound is produced. This is pericardial friction.

It is rough, rubbing, or grating in character, and being synchronous with the heart's action, is nearly always double, though it may be heard during systole or diastole only. It appears superficial, and as though close under the ear.

When much effusion into the sac follows the dry stages of inflammation, the sound is no longer produced, owing to the separation of the roughened surfaces by the fluid.

When the pleura over the pericardium is inflamed, the movement of the heart may cause a friction by the rubbing of the two layers of the pleura. This is pleuro-pericardial friction, its origin being in the pleura over the pericardium.

GENERAL OBJECTIVE SYMPTOMS OF CARDIAC DISEASE.

Palpitation. — Palpitation, or tumultuous rhythmical action of the heart, is a common symptom in functional and organic disease of the heart or pericardium.

It occurs when there is more or less sudden demand of work from the heart in excess of its powers, as in acute or chronic diseases of the heart and pericardium, anæmia and debility, in altered conditions of the quantity and quality of the blood, as in anæmia and plethora, and in some specific and other general diseases.

If the additional strain put upon the heart be sudden and temporary, the result is only a transient attack of palpitation. If persistent, hypertrophy may be induced.

It may also be caused by nervous influences. The latter may be of reflex origin, as when palpitation accompanies acute or chronic intestinal disease ; or it may be of central or intrinsic origin.

Palpitation may be continuous, or may occur at intervals only. It is generally accompanied by increased frequency and apparent force of the heart's action, and may be regular or irregular in force and in rapidity.

Pain is rare, but there is usually anxiety and hurried breathing.

In paroxysmal attacks depending upon nerve-irritation and disturbance, there may be fainting and actual syncope.

Treatment of Palpitation.—When palpitation is dependent upon anæmia and general debility, tonics, especially salts of iron, are indicated, and the diet should be nutritious and digestible.

When it results from nervous excitement, quietude should be enjoined. Internally, digitalis and potassium bromide and belladonna, are valuable remedies. Chloric ether, opium, and hydrocyanic acid are also of great efficacy.

In very bad cases, Fleming's tincture of aconite, in 6 to 8 minim doses, has proved very successful in the treatment of this complaint.

When the palpitation is the result of cardiac or pulmonary disease, it is treated in connection with the disease with which it is associated.

Irregularity.—Irregularity of the heart's action may affect either the rhythm or the force of the beat, and is of more serious importance than palpitation. It is probably closely related to defective nutrition of the substance of the heart itself.

It is common in dilatation of the heart.

Irregularity of force is common in the horse in incompetence of the mitral valves with dilatation of the left ventricle.

Intermittence.—Intermittence of the heart's action is a still more serious indication of cardiac failure than palpitation and irregularity. It is due to temporary arrest of the ventricular systole. It may arise from imperfect filling of the ventricle, as in fatty heart, or from great obstruction to the outflow of the blood, as in aortic obstruction. It may be of purely nervous origin.

Cyanosis is a condition very rarely met with. It only affects very young animals, and they only live a very short time. It is due to patency of the foramen ovale, and consequent mingling of arterial and serous blood.

It is manifested by blueness of the visible mucous membranes, difficulty of breathing, and coldness of the surface.

ACUTE AFFECTIONS OF THE HEART.

ACUTE ENDOCARDITIS.

Definition.—Is inflammation of the endocardium lining the cavities and valves of the heart.

Etiology.—Acute endocarditis in horses is usually associated with pericarditis, and endo-pericarditis is the most frequently met of all acute diseases of the heart. It is especially observed in rheumatism, several specific fevers, in pyæmia, and many forms of septic poisoning.

Acute endocarditis as a primary affection is probably very rare in the horse. Mr. C. Gresswell, of Nottingham, has, however, had several cases of this disease in young thoroughbred foals.

Symptoms.—Inflammation of the endocardium is in most instances attended with pyrexia, increased frequency of the pulse, and dyspnœa. When it follows in the course of rheumatic inflammation there is exacerbation of the febrile manifestations and obvious cardiac disturbance.

The heart's action is tumultuous, and apparently forcible, but the pulse is feeble. In listening to the chest we may hear pericardial friction, if the outer serous membrane is inflamed, and cooing murmurs, though sometimes audible in endocardial inflammation, are so frequently disguised by other abnormal sounds, as not to be relied upon in forming our diagnosis. The sounds produced are very much like those occasioned by a bellows. Hence it has been called a 'bellows murmur.'

Clonic spasms of the superficial muscles of the anterior part of the body are present in many cases of endocarditis.

Owing to the uncertain character of the symptoms, endocarditis is not easily diagnosed from pericarditis.

An animal, when suffering from acute endocarditis, exhibits great distress, and the appetite is almost entirely arrested. Sometimes even complete anorexia may supervene. The 'cooing murmur,' or rather the 'bellows murmur,' can be distinctly heard, by even the inexperienced amateur, over a large area of the chest. This sound is quite diagnostic, and it may be said that acute endocarditis is a disease which is frequently fatal in horses.

Sequelæ.—Inflammation of the endocardium is usually followed by structural changes of the valves, and this change induces dilatation and alteration in the cavities of the heart. Weakened cardiac action and dropsical effusions may follow in various parts of the body.

Morbid Anatomy.—The endocardium consists of a layer of connective-tissue with an endothelial lining. The inflammation is more marked round the orifices and in connection with the valves and their appendages, and, in rheumatism, particularly in the valves. During the inflammatory process the deeper layers of the endothelium become rapidly infiltrated with young cells, and the inter-cellular substance becomes softened and destroyed, and thus there is formed a soft tissue composed entirely of cells. This new tissue projects through the endothelium in the form of minute granulations and vegetations upon the surface of the softened valve. There is also more or less increase of vascularity in the external endothelial layers; but the above changes occur in an almost non-vascular tissue.

The roughened granulations act as foreign bodies, and thus frequently induce coagulation or deposition of fibrin upon themselves.

The cell infiltration may break down, and form an endothelial ulcer or a small abscess. The inflammatory process is generally, however, less intense and malignant. The granular valves may then adhere to each other or to an inflamed patch in the wall. The new cell growths become organized into a fibrinated structure, whilst in part it undergoes fatty and calcareous degeneration.

These changes produce permanent thickening, rigidity, and shrinking of the valves, and consequent insufficiency or stenosis, or both.

The new tissue may continue to grow after the process has subsided, and thus are produced vegetation and papillary excrescences on the valve. These consist of a lowly organized tissue, which tends to undergo fatty and calcareous changes.

Treatment.—The treatment resolves itself chiefly into the treatment of the diseases with which the endocarditis is associated.

Cardiac sedatives are indicated when the irritability and pain are great, but must be given with care. Bleeding is recommended by some; but as it probably only gives temporary relief, and probably favours coagulation and the deposition of the fibrin on the roughened surfaces, it is best not to adopt this measure.

In cases where debility and exhaustion follow, stimulants in moderate doses are necessary.

MYOCARDITIS.—The muscular substance of the heart may be the seat of inflammation, whereby it becomes softened or, more rarely, indurated. Intense and concentrated inflammations, leading to the formation of abscess, may occur as the result of a pyæmic process. Myocarditis rarely occurs except in connection with disease of the endocardium and pericardium, whence the inflammation spreads to the muscular tissue itself. It is an occasional sequel of various acute fevers, and of pyæmia and other septic conditions of the blood.

It gives no distinctive symptoms during life by which it may be recognised, but the heart's action is weak and irregular.

CHRONIC AFFECTIONS OF THE HEART.

ENLARGEMENT OF THE HEART.—**Hypertrophy and Dilatation.**—Enlargement of the heart may result from increase in size of the muscular walls, or from increase in the capacity of the cavities. When the heart is hypertrophied without any alteration in the capacity of the cavities, the condition is termed *simple hypertrophy*. When there is increase of capacity of the cavities, without enlargement or multiplication of the muscular elements or thinning of the walls, it is termed *simple dilatation*. When the muscular structure is increased, and there is also increase in the capacity of the cavities, it is termed 'hypertrophy with dilatation,' or *eccentric hypertrophy*. It is doubtful if hyper trophy with diminution of cardiac capacity occurs, but it has been mentioned under the term *concentric hypertrophy.*

Etiology.—Hypertrophy with or without dilatation may, in most instances, be regarded as a compensatory condition, owing to some obstruction to the circulation. It may be induced by long-continued overwork; and in hunters and racers hypertrophy, or hypertrophy with dilatation, is of frequent occurrence. Hypertrophy may also result from frequently recurring or persistent palpitation.

The obstruction to the circulation may occur at the cardiac orifices, or at the orifices of the large arteries, especially at the mitral and aortic openings. The obstruction to the blood-flow may be in the pulmonary circuit, as in bronchitis and emphysema, and occasionally it may be in other organs. Dilatation with hypertrophy is a frequent result of aortic or mitral incompetence, owing to the regurgitation of the blood.

Symptoms.—Vary widely, according to the seat and extent of the enlargement, and to the diseases with which it is associated.

In many cases, where the hypertrophy is compensatory, there are no symptoms. When the hypertrophy is considerable and in excess of the dilatation, the arteries tend to become fuller, the veins less full, and the circulation is accelerated. The pulse, at first full, becomes feeble as the dilatation increases.

The impulse of the heart is increased and is sometimes prolonged; and in very marked hypertrophy is often observable at a distance from the animal, and may be distinctly felt.

The heart-sounds may be more intense, but are usually less distinct.

When dilatation is in excess, the veins tend to become over full, the arteries less full, and the circulation retarded.

The pulsations are smaller, feebler, and more irregular or intermittent; and there may be dyspnœa, especially when exertion is made. In advanced stages there is coldness of the extremities, and a tendency to œdema or dropsical effusions. The jugular venous pulse is most often noticed when the right side is dilated. So long as the hypertrophy keeps pace with dilatation there may be no symptoms; but when the hypertrophy ceases to progress, while the dilatation increases, symptoms are soon manifested from impairment of the heart's action. Exertion in this case is attended with much difficulty.

Morbid Anatomy.—The heart is increased in weight and bulk, the relative extent of which depends upon the relation between the hypertrophy and the dilatation. The shape is also often modified according to the parts involved, and is generally rounder than natural. The auricles are much less frequently enlarged than the ventricles, and the left ventricle more often than the right.

ATROPHY OF THE HEART.—Atrophy, or decrease of substance of the heart from diminution in the size or in the number of the muscular elements, is general or partial. It may be attended by thinning of the walls and dilatation of the cavities, when it is called *eccentric atrophy;* or it may occur without alteration in the capacity of the cavities, when it is called *simple atrophy.* There is much weakness with feeble cardiac impulse, which is felt only over a small area; but there are no diagnostic symptoms of this condition.

CHRONIC VALVULAR AFFECTIONS. — Valvular disease may arise from acute or chronic endocarditis; from atheromatous or calcareous changes; from enlargement of the orifices; and, lastly, from congenital malformations.

It has been already mentioned that disease of the valves may allow of regurgitation of blood owing to insufficient closure; or may cause obstruction to the onflow of the blood, owing to constriction or partial blocking of the orifice, resulting from adhesion of the valves or thickening of the structures around the opening.

Each orifice is then capable of each kind of disturbance: regurgitation and constriction. There may be theoretically, therefore, eight kinds of murmurs, viz.: (1) Aortic regurgitation and constriction; (2) Mitral regurgitation and constriction; (3) Pulmonary regurgitation and constriction; (4) Tricuspid regurgitation and constriction.

Auscultation is attended with great difficulty in the horse, and, in consequence, our means of diagnosing valvular affections are far more limited than in man.

Disease of the left side is more common than on the right. In disease of the valves of the left side, the pulse is altered in character and rhythm; while in disease of the right side, the chief manifestations are in the venous circulation. Jugular pulsations are very commonly visible, and dropsical effusions and anasarcous swellings liable to follow. Yet it is to be remembered that, in disease of the left side, the right side may soon become disordered in consequence.

In the horse, the mitral and aortic valves are more specially liable to be diseased. In many instances both valves are involved simultaneously. Probably the commonest form of valve disease met with in the horse is aortic obstruction and mitral regurgitation. During auscultation, if we are in doubt whether a murmur occurs during the systole or diastole, we may feel the pulse at the jaw or fore-arm while we listen. If the murmur is *systolic*, it will of course be heard at the same time, or nearly so, *as the pulse beat is felt;* if *diastolic*, it will be heard *between the beats of the pulse.*

Mitral Regurgitation.—At each systole of the left ventricle blood flows back or regurgitates into the left auricle. The pulmonary circulation thus becomes overloaded, and is subjected to increased pressure. This difficulty is met, for a time, by compensating hypertrophy of the right ventricle. Hence, during this stage there are no symptoms of ill-health, though there is not unfrequently difficulty of breathing during exertion. After a time the hypertrophy of the ventricle gives way to dilatation. Thus the engorgement and tension of the pulmonary vessels is increased and reflected back through the right side of the heart to the systemic veins, which now also become overloaded, just as they do from the first in cases of disease of the valve of the right side. In consequence of the mitral regurgitation being no longer compensated for by increased force of the right ventricle, the aorta now becomes under-filled.

Hence symptoms of systemic venous congestion follow. Pulmonary complications with cough are sometimes present, the breathing is disturbed, and there is severe dyspnœa when the horse is much excited or during severe exertion.

The pulse is small, feeble, and often irregular and intermittent.

Mitral Obstruction.—The clinical history of mitral obstruction is similar to that of mitral regurgitation, with which it is in many cases associated. In the horse we do not know that the murmur characteristic of this disease in man has ever been distinguished. This murmur in man immediately precedes the systole, and is therefore termed presystolic. It is due to the passage of the blood from the left auricle through a constricted mitral orifice.

Tricuspid Regurgitation.—In this disease, at each contraction of the right ventricle blood passes back through the tricuspid valves into the right auricle, and thence into the venæ cavæ and jugulars, which thus become rapidly dilated and overloaded.

A reflux pulsation in the jugulars with each ventricular contraction is pathognomonic of tricuspid regurgitation.

In this disease a systolic murmur is heard, as in mitral regurgitation, but we cannot distinguish the two murmurs in the horse.

Aortic Obstruction.—When the aortic semilunar valves obstruct the onflow of blood through the orifice, a murmur is produced *during systole.* When they allow of regurgitation back into the ventricle, the murmur is *diastolic.*

When both conditions are present, both murmurs are produced. In obstructive disease, the left ventricle hypertrophies to overcome the resistance; but after a while the mitral orifice, with the valves there, becomes involved, and the equilibrium breaks down. In consequence of this, the symptoms of mitral regurgitation are manifested.

Aortic Regurgitation.—In this disease the blood-flow is retarded; for after every contraction of the left ventricle, part of the blood regurgitates back from the aorta into the ventricle. The left ventricle therefore hypertrophies, in consequence of the increase of work thus thrown upon it.

After a time the hypertrophy gives way to dilatation, owing to impaired nutrition and degeneration of the cardiac walls, arising from imperfect filling of the coronary arteries during the ventricular systole.

Implication of the mitral valve follows after a while, and the symptoms of mitral regurgitation are manifested.

The pulse in aortic regurgitation is sudden and jerky, and is termed the 'water-hammer pulse,' or 'Corrigan's pulse.'

In aortic obstruction the pulse is not materially altered.

TREATMENT OF CHRONIC VALVULAR DISEASES.—The treatment of the valvular diseases can only be palliative, and in most instances it is not an object to prolong life in horses incapable of exertion. Regulation of work, which should not be in excess of the powers of the animal, and good diet, are the first essentials in the treatment of cardiac diseases.

Tonics, such as iron, nux vomica, and other vegetable tonics, are indicated in most cases, but we must, in all cases, treat the symptoms as they arise. When there is great irritability of the heart, belladonna, bromide of potassium, and chloric ether are of service in alleviating the distressing symptoms. Digitalis is of great efficacy as a heart tonic, and is indicated whenever cardiac failure is threatening.

DEGENERATIVE CHANGES OF THE HEART.

FATTY DEGENERATION OF THE HEART.—Under the term fatty degeneration are included two different pathological conditions. These are fatty metamorphosis, or degeneration proper, in which the fat is derived from the metamorphosis of the cardiac muscle, and fatty degeneration, where it is derived from the oleaginous, saccharine, or nitrogenous principles of the food.

These two conditions may occur together, and are not unfrequently associated with other abnormal conditions of the heart, as partial or general dilatation.

Fatty Infiltration.—In health there is a certain quantity of fat covering the surface of the heart, beneath the visceral layer of the pericardium. Under certain circumstances—for example, from want of sufficient exercise—the fat tends to accumulate around the base and origin of the great vessels, and also to gradually insinuate itself between the muscle fibres. The fat is always more abundant near the surface.

Fatty Metamorphosis.—This condition may affect the cardiac muscle throughout, or in portions only. The muscle becomes softer and more friable, and often breaks with a granular fracture. It is more flabby, paler, and more opaque than normal cardiac muscle. True fatty degeneration is mostly met with in cases of dilatation of the cavities with thinning of the walls of the heart. It is also a not uncommon result of aortic incompetence, in which disease the circulation in the coronary arteries is interfered with, and the heart muscle is badly nourished in consequence.

Diffuse fatty degeneration sometimes occurs in acute specific fevers.

There are no diagnostic symptoms of fatty change in the heart, though degeneration renders the organ weak and incapable of performing any unusual exertion, or, if advanced, of even carrying on the normal circulation.

CALCAREOUS DEGENERATION OF THE HEART.—Cases of calcareous change in the cardiac muscle of the horse are very rarely met with. Only two cases are recorded, and in each the right auricle only was calcified.

RUPTURE OF THE HEART.—Rupture of the heart is very rarely met with. In most instances it is due to some previous pathological condition of the organ. The immediate causes are over-exertion and shock, resulting from a fall or from direct violence to the chest.

It is of most frequent occurrence in aged horses, after sharp exertion.

The usual seat of the rupture is at the conus arteriosus of the left ventricle, where the tendinous ring unites the great aorta with the ventricle.

Mr. Percival records an instance of rupture of the right auricle in the horse occurring shortly after a race. In January, 1888, we found, when making a post-mortem examination on a pig, that a complete rupture of the wall of the left ventricle had taken place. This rupture was 2½ inches in length.

NEW FORMATIONS IN CONNECTION WITH THE HEART.—The new formations met with most commonly in the heart of the horse are malignant and parasitic growths, cardiac polypi, and vascular tumours.

The effects of these growths on the health of the animal vary chiefly in accordance with their situation, and also, but to a less extent, with their nature.

Occasionally the heart is the seat of malignant growths, which though possibly originating in the organ itself, are with greater probability regarded as sequels of the general invasion of the system by cancerous growths.

Hydatid cysts have been described in connection with the heart in cattle and sheep, and they may also occur in the horse.

Single individuals of strongylus armatus have been found in the pericardial sac of young horses by Professor Robertson.

Vascular tumours in the heart are due to dilatation of the veins and capillaries beneath the endocardium.

Of all cardiac growths, the most frequently met with are the so-called fibrinous polypi, which seem to originate from the muscular tissues of the heart. They are composed of laminated fibrin, the central parts being more distinctly organized and fibrillated.

Cardiac tumours cannot be diagnosed during life.

ANGINA PECTORIS.—In man, angina pectoris (*ἄγχω*, to strangle; *pectus*, the breast), or breast-pang, is a disease of the heart characterized by paroxysmal attacks of neuralgic pain in the chest, and is rarely met with in men under 45 years of age. This affection is believed by Williams to affect the horse sometimes, and, indeed, from the frequent occurrence of heart disease in this animal, this is only what we might expect. This author describes a case in an aged horse brought to him for examination. For twelve months the animal had done very little work, owing to the fact that when excited by work he manifested severe agony in the near fore-limb. In this case the heart was manifestly diseased.

DISEASES OF THE PERICARDIUM.

ACUTE PERICARDITIS.

Definition.—Inflammation of an acute type affecting the pericardial membrane.

Etiology.—Acute pericarditis may appear as a primary or idiopathic affection from cold, damp, exposure or fatigue. It is, however, most frequently met with in association with other diseases, rheumatic fever especially. It is also often associated with strangles, influenza, purpura, pyæmia, and other septic conditions of the blood. It may result from spreading of inflammation from the lungs and pleura, or from the irritation of new growths, or from parasites in the sac.

Finally, it may be induced by wounds or by fractured ribs.

Symptoms.—The symptoms of pericarditis are very variable, and when unassociated with general disease may be very indistinct and obscure. Generally pericarditis is met with in association with endocarditis, and in these cases the symptoms are very difficult to distinguish.

The disease, when severe, is usually ushered in with considerable fever. The pulse is short, hard, irritable, and accelerated, and the heart's action is often irregular. Sometimes the pulse is bounding and violent; sometimes, when there is much effusion, it is feeble and fluttering. The respirations are accelerated; the extremities are cold; cough is often present, and there is pain, especially during movement. In less severe cases there is less constitutional disturbance, and correspondingly less pathological change.

Debility is sometimes very marked.

Associated with the pericarditis, spasms of the superficial muscles have often been observed. These spasms or cramps are in most instances confined to the muscles of the pectoral region and neck, but occasionally, also, the posterior extremities are affected.

The friction characteristic of pericarditis in man is not always detected in the horse. When heard, it is a rasping, grating to-and-fro sound, synchronous with the cardiac action.

If this sound be associated with a deeper seated murmur in the heart, endocarditis is also present. When the effusion supervenes the friction disappears, and is replaced by a dull churning noise of the heart movements. If the effusion be considerable, the pulse becomes feeble, fluttering, and irregular. There may also be visible carotid and jugular pulsation, with great distress in the breathing, and œdema may appear in various parts.

In influenza, pericarditis is a somewhat frequent complication.

The symptoms in this form of pericardial inflammation vary much, being sometimes well marked and sometimes very indistinct. They are best marked in cases where the lungs and pleura are free from disease.

Prognosis.—Pericarditis may terminate in partial recovery with adhesions, in complete recovery, or in death (usually by syncope). The prognosis is not unfavourable except in very severe cases.

Morbid Anatomy.—The anatomical changes in pericarditis vary considerably with the severity and nature of the attack. On the whole they resemble those already described in inflammation of the pleura.

The effusion, which is sero-fibrinous, is usually considerable, and when small may soon be absorbed.

Complete restoration is rare, for more or less extensive adhesions and agglutination usually persist. In many cases the plastic material effused spreads over the surface of the heart, assuming a reticulated appearance of considerable thickness.

In some cases the effusion is blood-stained, and in others it may mingle with pus. In the pericarditis of acute rheumatism and epizoötic fevers the cardiac muscle and the endocardium are also generally involved.

Treatment.—In the early stages of primary pericarditis, with a full hard pulse, Fleming's tincture of aconite, with nitric ether and liquor ammoniæ acetatis is recommended in moderate doses. If the pain continue unallayed, tincture of opium should be substituted for the aconite. Digitalis does not seem to have a beneficial action in pericarditis. Tincture of convallaria in one-ounce doses has been found by us to be very useful. In the early stages some recommend moderate bleeding, which they repeat a second time if necessary, or follow up the first abstraction of blood by the administration of Fleming's tincture. Under no circumstances should bleeding be adopted, except to relieve urgent symptoms in the early stages, as in pericarditis there is great tendency to early diminution of the cardiac power.

Woollen cloths wrung out from hot water should be wrapped round the chest, as in pleurisy, and should not be reapplied for a couple of hours. During the intervals the left side may be well rubbed with some stimulating liniment containing tincture of opium. The legs should be carefully bandaged, and the food should be nutritious and easily digestible. After the early stages are over and effusion sets in, a cantharides blister applied over the cardiac region is very useful. Stimulants and tonics, such as the salts of iron, with diuretics or potassium iodide, may now be given internally.

When the pericarditis is associated with rheumatism, the treatment does not materially differ from that above described. Colchicum is useful internally, but aconite or opium are perhaps preferable. Bicarbonate of potash and nitric ether may be given in addition; and the woollen cloths should be applied to the chest as in the idiopathic variety.

When associated with the specific fevers, pericarditis should not be treated apart from the general disease. Moderate blisters may be applied to the left side, and stimulants and potassium iodide given internally. When the fluid in the pericardium remains unabsorbed, and there is in consequence serious interference with the heart's action and great difficulty in breathing, the fluid should be removed by paracentesis or puncturing of the pericardial sac.

HYDROPS PERICARDII.—Dropsy of the pericardium, or hydrops pericardii as it is termed, may follow an attack of subacute pericarditis, but in most instances it is part of a general dropsy.

The fluid is purely serous, thus differing from that of acute pericarditis. There are usually no symptoms by which this condition can be diagnosed during life.

CHAPTER VII.

DISEASES OF THE ALIMENTARY SYSTEM.

GENERAL REMARKS ON DISEASE OF THE ALIMENTARY CANAL.

ALTHOUGH science has been amplified and extended to such an extent in our time that we may almost speak of it as having been placed upon an entirely new basis; although the most wonderful and far-reaching discoveries, previously not even dreamt of, have been made in the departments of physiology, chemistry, physics, agriculture, and medicine; and although veterinary science, no less than other branches of knowledge, has made most sure and rapid advances onwards, yet nevertheless it does seem to be the case that diseases and disorders caused by the very grossest errors in feeding are nearly as common as they ever were.

It is very essential that the food-supply of horses should be well and thoroughly attended to. It is, in the first place, highly important that our grooms should be up in the morning at 5.30 or 6 in order to feed the horses under their charge, and allow them sufficient time to digest their food. The diseases of the digestive organs of the horse are the most commonly encountered of all the equine maladies. In the second place, it is to be observed that, as they are as a rule due to dietetic errors of one kind or another, they may be very easily guarded against. In the third place, when recognised in the early stages, they are very readily amenable to judicious care and treatment.

In the case of the horse, the intestinal tract is more liable to become diseased than the stomach, whereas in the case of the ox and the sheep the latter organ is more frequently affected. This is no doubt due to the fact that in the horse the stomach is much less complex than in the case of ruminants, and is also smaller in proportion to the rest of the intestines than in those animals. Indeed, the process of digestion, begun in the stomach of the horse, is largely completed by the intestines.

The mechanism of digestion in the horse and the higher animals and man consists of a long tube which runs through the body, beginning at the mouth and ending at the anus. In the mouth the food is acted upon by the salivary secretion, and is passed on into a cavity called the pharynx, which leads to the gullet. This tube passes down the neck behind the windpipe, and thence through the chest into the abdomen, where it opens into the stomach. The stomach in the horse is very small when compared with the extensive intestinal tract. We should, in this connection, remind our readers of a fact which they all well know—namely, that the body-cavity of the horse, as of all higher animals, is divided into two halves by a sheet of muscle called the diaphragm, which stretches across from side to side. The front cavity thus partitioned off is the thorax or chest, and the hinder one is the abdomen. When the food enters the stomach, it is acted upon by the gastric juice, and it then passes on into the intestines, wherein it is again altered, and rendered assimilable by the secretions of the liver, and by those of the pancreas and the intestinal walls. When the food has passed through the various necessary changes prior to its absorption, the residue passes onwards, to be ultimately expelled at intervals from the system.

The horse is herbivorous, and consequently, owing to the large amount of food which must be taken by this animal, as by other creatures which feed upon vegetable material, in order to obtain the necessary amount of nutriment, the digestive tract must present a large area for absorption. Dogs, cats, and other animals which live upon flesh, do not need to eat such a large quantity of food in order to obtain the sustenance which is necessary. Hence their digestive organs are less liable to suffer, when the animals are kept in a state of domestication, than those of herbivorous animals are.

The little tadpole lives upon vegetable matter, and has in consequence a very long intestinal tract; but when the little creature becomes transformed, and takes on the characters of a frog, which is a creature of carnivorous habits, the digestive canal is also altered in form, and the intestines become much shorter.

Professor Williams points out the important fact that easily-digested food taken by animals in excess is liable to derange the small intestines; whereas coarser and more indigestible food containing much woody fibre, such as over-ripe hay, rye-grass, and coarse straw, is more apt to accumulate in the large intestines, thereby causing disordered action, inflammation, or even paralysis of the intestinal muscular tissues. Boiled food is also apt to be retained in the stomach, and, if it be given in excess, it is liable to cause distension, inflammation, or even paralysis or rupture. It is, moreover, not only the bad quality of the food which may produce disorders in the alimentary tract, but irregularity in diet and full feeding after exhaustive work may also be very liable to cause disease.

The average capacity of the stomach of a horse of ordinary size is sufficient to hold from three to three and a half gallons; but it must be remembered that it varies greatly according to the bulk of the animal, the breed, and the nature of the food. Relatively speaking, the stomach is more considerable in more coarsely bred horses, and also in the ass and the mule. When it is empty, the stomach of the horse weighs about three or four pounds.

On its external surface the stomach is seen to be of uniform appearance; but if the interior be opened, one is at first struck by the different aspect which its lining membrane presents, according as it is examined on the right side or on the left side. To the left the stomach presents all the characters of the lining of the gullet, in being white, harsh, and even resistant, and it is covered by a thick layer of epithelial cells. To the right the lining is thick, wrinkled, spongy, very vascular, and has a reddish-brown tint, which is speckled by darker patches. Here it loses its harsh consistency, and is deprived of the remarkably thick epithelial covering which it exhibits on the left side, being covered by a very thin layer of epithelial cellular structure.

It is by a quite sudden transition that the lining membrane of the stomach of the horse is thus divided into two distinct parts. Of these two parts, the right constitutes what may be called the true stomach of the horse, since on it alone devolves the secreting function and the elaboration of the gastric juice, the fluid by means of which the food is digested. The left part, on the other hand, is generally looked upon as being a dilatation of the gullet (Chauveau).

When the horse is living in the wild state, it lives upon the grass of the field, and the smallness of the stomach is in itself sufficient evidence that the organ is so constituted as to require to be frequently replenished in order to duly nourish the animal. When, however, domestication is undergone, the conditions of life are entirely and radically changed. The chief part of the food is now given dry, and it is thus very clear that the functions of the stomach must be to some extent altered in correspondence with this and other unavoidable changes.

Again, when out at grass, the horse has plenty of time for feeding, and likewise in the stable he requires ample leisure for this purpose. We must remember that the drier the food may be, the more saliva is secreted, and the longer it is retained in the mouth, in order that the starchy material contained in it may become converted into soluble sugar. Of course, as we all know, horses do not ruminate, as bovine animals do. The ox, having filled the mouth, bestows but little care upon the comminution of the food. This animal moves the jaws twice or thrice, thus forming the herbage into a conveniently-sized pellet, and then passes it at once to the rumen. This receptacle (the rumen) is large, and it is filled rather hastily. Then the ox retires to a quiet spot, and there enjoys the meal, the grass being regurgitated into the mouth, and therein fully masticated. When engaged in this process the ox is said to be ruminating, or chewing the cud. The horse possesses no such power as this. The food must be once for all eaten and well masticated before it enters the stomach, and for this operation to be well done the horse requires a due amount of time. As is well known, the Tartary horses are trained so as to be able to undergo prolonged fasts, and to live on small quantities of food, and they are in consequence perhaps the hardiest of horses. They have been specially trained to their mode and habits of life; and as factors in the bringing about of this result we may mention, on the one hand, the artificial selection by man of the hardiest dams, and, on the other, the dying-off of the weaker animals. These horses of Tartary are not supplied with large quantities of oats, hay, and other fodder, immediately after exertion; but they are, on the contrary, managed with extreme care, and therefore become very hardy. However, we may point out that on no account ought we to expect our horses to undergo long fasts: they should be well and regularly fed.

When food is swallowed, and enters the stomach, the gastric glands pour out a secretion—the gastric juice—and this fluid, unlike the saliva, which acts on the starchy foods, acts on the albuminous constituents, and renders them capable of absorption through the intestinal walls. The gastric juice also dissolves the albuminous coatings of the fat-cells, and sets free the fat to be acted upon by the bile. When we consider what changes the food must undergo in the mouth and stomach before it can be absorbed, it will be seen that two hours should always be allowed before a horse is worked after it has been fed. There is still one more fact which must be mentioned before we pass on to the consideration of the disorders of the stomach, and it is one which clearly indicates that the horse is by nature a constant feeder. In man, in the ruminating animals (such as sheep, camels, deer, oxen, giraffes), and in the carnivora (such as the dog, cat, lion, tiger, and so forth), and many other animals, the bile, which is the fluid secreted by the liver, is, in the first place, collected in a little bag or sac called the gall-bladder. This fluid is afterwards poured out into the small intestine, to act on the food as the latter is being carried onwards past the opening of the gall-duct into the small intestine. Now, in the horse there is no gall-bladder, and so the bile flows constantly and directly into the first part of the small intestine. When the horse is worked immediately after a meal, the blood, from which the digestive juices are directly or indirectly drawn, is required to repair the loss of tissue caused by the waste of the muscular tissue. When a muscle acts, work is done, and there is a waste of tissue, and this waste must be repaired. Consequently, if an animal be worked immediately after a meal, the food remains undigested, and hence irritation of the stomach and intestines, and various diseases, such as colic, stomach-staggers, and other affections, result.

SECTION I.

DISEASES OF THE MOUTH AND THROAT.

STOMATITIS.—Inflammation of the mouth occurs in several forms, and we have already considered a contagious disease of the horse in which the specific pustular formations have their special seat on the buccal membrane.

Causes.—Stomatitis is most frequently met with in young animals, and is especially predisposed to by malhygienic conditions and improper dieting. It may be due to local irritation or to mechanical causes, and is sometimes produced by extension of morbid action in the parts near, or may follow disorders of the alimentary canal.

It often occurs in animals debilitated by disease, and is in many instances traceable to certain vegetable fungi, or to a special acarus. The oidium albicans, one of the hyphomycetes, has long been recognised as the active cause of some forms of stomatitis.

Varieties and Symptoms :—

Simple, or Catarrhal Stomatitis.—This form is chiefly met with in foals. It first appears as small circumscribed red patches on the buccal membrane of the cheeks and roof of the mouth. These patches are covered with a yellowish film, which soon separates, and leaves a superficial erosion.

The excoriated patches gradually coalesce, and thick saliva, mingled with the products of inflammatory action, accumulates in the mouth. There is an unhealthy fœtid odour in the mouth, and the buccal membrane is somewhat thickened and congested.

This form is occasionally seen in old animals, and in many instances is associated with disordered digestion.

Vesicular Stomatitis affects both young and old animals.

It may accompany the simple variety, but generally occurs as an independent affection.

In this form small vesicles appear on the buccal membrane of the cheeks, around the angles of the mouth, and on the sides and frænum of the tongue.

They soon rupture, and leave minute ulcers, several of which frequently coalesce.

Pustular Stomatitis.—The vesicles in the preceding form may develop into pustules, and thus this variety is sometimes a sequel of vesicular stomatitis. In most instances, however, pustular stomatitis first appears as small yellowish spots, developing into distinct pustules, which rupture, and leave small, deep ulcers.

Treatment of Stomatitis.—The hygienic and dietetic arrangements should be attended to in the first place.

As local applications, chlorate of potassium, 15 grains to the ounce, or carbolic acid, 1 part in 40, are recommended. If the ulcers become indolent, they may be touched with a solution of sulphate of copper, a scruple to the ounce, or silver nitrate, 10 grains to the ounce.

Internally, antacids, such as bicarbonate of potash, with vegetable tonics are required in some cases, and they may be preceded by the administration of a mild purgative.

GLOSSITIS.—Inflammation of the structure of the tongue is rarely met with in the horse, except when resulting from the action of irritants, or from mechanical injury. It may follow on inflammation of the neighbouring structures.

The tongue becomes swollen, tense, and painful from the inflammatory infiltration, and soon protrudes in consequence of its increase in size. There is difficulty in swallowing, and ropy saliva and mucus accumulate in the mouth.

Treatment.—Gargling, firstly with warm water, and afterwards with antiseptic or astringent lotions, is recommended. Laxatives, if required, must be given per rectum.

PAROTITIS.—Inflammation of the parotid gland may affect one or both sides, and is a frequent accompaniment of strangles.

Parotitis is acute or subacute, and is often met with associated with or supervening on various febrile attacks.

Symptoms.—When of an acute type, parotitis may quickly terminate in abscess of the gland. The inflammation, however, is usually of slower progress, and reveals itself by gradual swelling and tenderness of the gland, with difficulty in moving the head and protrusion of the nose. The inflammation may gradually subside, or it may terminate in abscess, which, if not opened, may burst into the pharyngeal pouch.

When the inflammation is very acute, the whole gland may be affected; but when not so intense, it is usually limited to a portion of the gland-structure.

Treatment.—Hot fomentations or poultices may be applied for a time, and if pus forms it should be liberated.

If the inflammation proceeds slowly, a cantharides blister or tincture of iodine of three times the B.P. strength may be applied. Internally, tonics and stimulants are indicated.

PTYALISM—SALIVATION.—Ptyalism or salivation is an abnormal increase in the amount of secretion of saliva, which dribbles away continuously, or collects in foam around the mouth.

We do not apply the term salivation or ptyalism to the escape of saliva from the mouth resulting from inability to swallow it.

The secretion of saliva is a reflex process, and salivation depends therefore either upon peripheral irritation, or upon undue action of the salivary nervous centres, or on both these conditions.

It is generally dependent on peripheral irritation occurring in some diseases of the mouth, pharynx, throat, and other organs; and may also result from irritation caused by irregularity of the teeth, or foreign bodies in the mouth. It may occur in rabies and tetanus, and in some instances no assignable cause is found.

Finally, it may be due to the administration of certain drugs.

Treatment.—In all cases the cause should be ascertained and removed, if possible.

If there be any irregularity of the teeth, this should be attended to.

Gargles of alum or chlorate of potash are often very useful in these cases. If the salivation continues, belladonna is worthy of trial.

ACUTE PHARYNGEAL CATARRH.—Inflammation of the mucous membrane and submucous tissue of the fauces and pharynx are common in influenza, strangles, and other specific fevers in which the air-passages are involved.

This form of pharyngitis we have already alluded to, as also we have to inflammation of these parts occurring as part of general catarrh. But this disease also occurs as an independent affection, from cold, exposure, damp, direct irritation, or disordered digestion.

Symptoms.—Deglutition is attended with difficulty, and sometimes with coughing, during which the food is expelled back into the mouth, and liquid through the nostrils. There is no fever or impairment of respiration unless laryngitis is also present.

Treatment.—Many cases recover in a few days with rest.

Inhalation of hot-water vapour medicated with carbolic acid or opium is very useful.

Gargling with solution of chlorate of potash or sulphurous acid may also be tried, and hot fomentations externally are useful in allaying the irritation.

In chronic cases, stimulating liniments or blisters may be applied.

POST-PHARYNGEAL ABSCESS.—Simple inflammation of the pharynx may terminate in the formation of abscess in the pharyngeal structures.

Suppuration in the parts, however, is more frequently met with in the pharyngitis occurring in some of the specific fevers, or in animals which have been exposed to malhygienic conditions. Abscess may also occur here as part of a general pyæmia.

Suppuration in the pharynx causes obstruction to deglutition, the breathing becomes difficult, and the throat is generally tender.

Treatment.—The treatment of pharyngeal abscess is essentially surgical. If the breathing become difficult, inhalation of hot-water vapour, and the hot fomentations externally, are useful. If the abscess do not burst, it may be necessary to open it, especially if breathing is very much interfered with.

SECTION II.

DISEASES OF THE ŒSOPHAGUS.

INFLAMMATION OF THE ŒSOPHAGUS.—Inflammation of the œsophagus is generally the result of direct injury. It may be induced by the passage of very large or hard portions of food, or by the administration of irritant liquids. It may be caused by external violence, and not unfrequently occurs as part of general catarrh of other mucous membranes. Inflammation of the œsophagus may result from rupture produced by careless or forcible passage of a probang, especially of an improper one.

Symptoms.—Difficulty of swallowing; tenderness on manipulation, and sometimes spasm of the œsophagus, are the usual symptoms manifested. In severe cases there may be febrile disturbance. When the inflammation occurs as the result of the administration of irritant liquids, as, for example, stimulating liniments given inadvertently, too hot water, or some poisons, as arsenic in solution, the submucous tissue may be much infiltrated. Perforation of the coats has been noticed in cases where the inflammation has been very severe.

Treatment.—Many cases do not require treatment beyond the use of liquid food for a day or two.

In severe cases linseed gruel, to which a little tincture of opium is added, is of benefit where there is much pain. Hot-water fomentations, followed by the application of stimulating liniments, are useful externally. Stricture of the œsophagus often follows severe inflammation.

STRICTURE OF THE ŒSOPHAGUS.—Stricture of the œsophagus may be left as the result of previous inflammation, or it may depend on tumours in connection with the walls or in the neighbouring structures.

Symptoms.—Gradual progressive difficulty in swallowing. The food often accumulates above the constriction, and the œsophagus above may become dilated and hypertrophied in consequence. Ejection of the accumulated liquid often follows.

Treatment.—Nutritious diet is required, and should be semi-solid or liquid. It is best to pass a probang in order to ascertain the cause of the obstruction and its extent. The stricture may be dilated in some cases, and recovery follow, but dilatation of the tube above the constriction will most likely remain. In stricture due to changes in the walls themselves, treatment will in all probability be of little avail.

When it is the result of tumours, the treatment will depend on the site and nature of the abnormal growth.

SPASM OF THE ŒSOPHAGUS.—Spasm of the œsophagus is not common in the horse, and the causes inducing it are uncertain. In some instances, however, it has been shown to depend on local irritation.

Symptoms.—When food, especially of a solid nature, is swallowed, it is, after travelling a certain distance, arrested for a time, and afterwards passes on, or is ejected suddenly, through the nose chiefly, but also through the mouth. The neck is usually bent, and the œsophageal muscles may be observed to undergo contraction.

Treatment.—If any obstruction is suspected, it is well to pass the probang, and morphia in full doses may be injected subcutaneously.

If the general health is disturbed, laxatives followed by tonics are indicated.

SECTION III.

DISEASES OF THE STOMACH.

GENERAL REMARKS ON SOME GASTRIC SYMPTOMS.

Flatulence.—Flatulence, or distension of the stomach and bowels with gas, results from fermentation, in the course of which carbonic acid chiefly, and other gases, such as sulphuretted and carburetted hydrogen, are also occasionally set free. Flatulence of this kind is probably due to alteration in the quality of the gastric juice, to feeble movements of the stomach and intestines, and to pyloric or intestinal obstruction, which, by retaining the food and impeding the process of digestion, favour fermentative and putrefactive changes.

Vomiting, or Emesis.—The rarity of vomiting in the horse has been attributed, firstly, to its small susceptibility to the action of nauseants; and, secondly, to the supposed difficulty attending the process from the anatomical conformation of the stomach in the horse. It is well known that the mucous membrane is gathered in folds or rugæ around the cardiac opening, and thus the food is prevented from escaping into the œsophagus.

Vomiting in the horse chiefly depends on reflex irritation, due to functional or organic diseases of the stomach. The ejected matters are chiefly expelled through the nostrils.

Vomiting has been observed in cases of gastric distension, and Robertson mentions some cases of young horses in which sickness was induced by eating haws. Some of these cases proved fatal, and in others marked prostration for several days followed the vomiting, which was attended with great distress. Vomiting also occasionally results from the injection of certain poisons, administered wilfully or with good intention. Every case of hellebore poisoning which we have been called upon to treat has been attended with nausea and several with actual vomiting.

Lastly, vomiting occurs in cases of rupture of the stomach, and has been noticed when there was dilatation of the lower part of the œsophagus close to its opening into the stomach.

The treatment of emesis will vary in accordance with the disease with which it may be associated, under which it will be again referred to.

INDIGESTION OR DYSPEPSIA.

Varieties: (1) Acute, and (2) Chronic Dyspepsia (δυς, with difficulty; and πεπτω, I digest).

1. ACUTE DYSPEPSIA, OR INDIGESTION WITH ENGORGEMENT. — **Etiology.**—Acute indigestion results from engorgement of the stomach with food, from imperfect mastication, and from the ingestion of indigestible material, or food specially apt to undergo fermentative changes. Cooked food, brewers' grains, maize, musty hay, and ripe vetches, are especially liable to cause impaction. Wheat and barley are also very likely to induce indigestion, and they frequently also cause purgation, laminitis, and may even lead to a fatal result.

Horses are more liable to dyspepsia after severe or prolonged exertion, especially if the food be difficult of digestion, or in too large a quantity.

Symptoms.—The symptoms of acute indigestion are generally sudden in their onset. There is fulness of the abdomen, and the horse is restless and shows indications of colicky pain. He lies down and rises again alternately, and paws the ground with his fore feet. Eructations of wind, occasional discharge of saliva from the mouth, and tremors of the superficial muscles, particularly those of the left shoulder, are also among the symptoms of acute indigestion.

In severe cases the pain is very acute, and the horse throws himself about wildly, and frequently looks towards his flanks. The pulse and respiration are accelerated, and in some instances there are attempts at vomition, and the discharge of brown fluid contents of the stomach with the eructations.

In some instances there is no manifestation of gastric pain, but the horse remains dull and semi-comatose, and the breathing may become stertorous; he refuses his food, is moved with difficulty, and attempts to press his forehead against a wall or tree, or anything which comes in his way. Under these circumstances the respiration is not much quickened, and the pulse is of full volume, but not so accelerated as when gastric pain is a prominent symptom. Such cases as these were spoken of by the older writers as *stomach staggers, and seem to be comparable with that form of gastric disturb-*

ance in man which is attended with vertigo and flatulent dyspepsia.

Prognosis.—In mild cases the prognosis is very favourable, and many recover without any treatment. In severe cases the prognosis must be more guarded, as death sometimes ensues from rupture of the stomach owing to the great distension of this organ, or from gastritis.

Treatment.—In the treatment of acute indigestion a purgative should be given at once in order to clear the stomach. For this purpose aloes is preferable to any other aperient, though oil or saline purgatives are recommended by some. If there be much flatulence it will be well to give a full dose of the aromatic spirit of ammonia. If there be much pain, an ounce to an ounce and a half of sulphuric ether, with half an ounce to an ounce of spirits of chloroform, may be administered in water or gruel, every two or three hours, as long as the pain continues to be severe.

In ordinary cases a draught composed of sulphuric ether, spirit of chloroform, and aromatic spirit of ammonia, given three or four times daily, will be found very beneficial.

Hyposulphite or sulpho-carbolate of soda may also be mentioned as useful remedies in dispelling flatulence, and hydrocyanic acid in 20 or 30 minim doses is very valuable in subduing gastric irritation. The intravenous injection of solution of sulphate of eserine in doses of from ½ to 1 grain may be very efficacious in cases of this disease.

Fleming's tincture of aconite is recommended in moderate doses by some eminent authorities, but we cannot speak very favourably of its value in this disease. In cases where there is any difficulty in administering liquids, acetate of morphia may be injected hypodermically.

If the bowels are not acted upon after the lapse of forty-eight hours or so, it is advisable to again administer some purgative medicine, but it is best not to repeat the aloes. Castor oil, in doses of one to two pints, will be found to answer the purpose as efficiently as anything else.

The treatment of indigestion with coma and cerebral complication does not materially differ from that above described.

Some have recommended the early abstraction of blood in these cases, but we agree with the view that this measure, if not harmful and calculated to impede recovery, is rarely of any advantage in the treatment of this disease. An aloetic purge, followed by the administration of sulphuric ether, spirit of chloroform, with full dose of potassium bicarbonate, is generally all that is required.

In all cases of acute indigestion which come before our notice it is necessary, firstly, to inquire carefully into the dietetic arrangements, and to advise the owner to have them more carefully regulated for the future.

In the treatment of this disease, as soon as the appetite returns, the diet should be at first of a laxative nature, and limited in amount.

2. CHRONIC INDIGESTION.—Etiology.—Chronic indigestion, like the acute form, is chiefly caused by dietetic errors, though these are not always apparent.

Sometimes the food, though of good quality, is too stimulating and dry; in other cases it is not sufficiently masticated, perhaps owing to irregularities in the teeth, but in most cases it will be found to be of inferior quality or administered irregularly.

Dietetic errors in their turn induce changes in the gastric juices and in the movements of the stomach, which, however, are sometimes deficient from impaired nerve-power.

Symptoms.—The symptoms of this affection are very variable. The appetite may or may not be impaired. Sometimes it is capricious and perverted. In other cases, though it continues good, the animal still continues to lose flesh. The bowels are generally irregular, the fæces often coated with mucus, and there may be great thirst and acid eructations. Abdominal pain is not unfrequent in severe cases, especially when the appetite remains unimpaired.

The horse is weak, sweats easily, and the skin is dry and hard.

Treatment.—The cause of the disorder should firstly be inquired into, and the dietetic arrangements carefully regulated.

If the disease proceed from imperfect mastication, due to dental irregularities, these should at once be attended to.

Some purgative should be given in all cases, unless the bowels are freely open, and should be followed by the administration of vegetable tonics, as gentian, nux vomica, quassia and chiretta, with full doses of potassium bicarbonate.

The diet should be limited in amount, and it will be advantageous to change it. When acidity of the stomach is a marked symptom, such antacids as magnesia, chalk, or subnitrate of bismuth may be administered. In the latter stages, nux vomica or quinine, with dilute mineral acids, may be given two or three times daily. Fowler's solution, given in the water with bicarbonate of potash, is also a useful means of restoring tone to the disordered stomach.

INFLAMMATION OF THE STOMACH—GASTRITIS.

Varieties.—(1) Acute; (2) Chronic Gastritis.

1. **ACUTE GASTRITIS.**—**Etiology.**—Though acute inflammation of the stomach is said to have been met with in the horse as an idiopathic affection, yet in most instances it results from irritation of the gastric mucous membrane. Sometimes it is an accompaniment of intestinal disease.

Irritation of the gastric mucous membrane is chiefly owing to dietetic errors. Under these circumstances it may be due to impaction of the stomach, or be traceable to constant dietetic mismanagement.

Irritation of the mucous membrane may also be due to the presence of foreign bodies in the stomach, or to the ingestion of certain poisons. In influenza, and in some other specific fevers, gastritis may accompany or follow after the primary disease.

The poisons which most frequently cause inflammation of the stomach are arsenic, mercury, antimony, copper, and sometimes lead salts. The foliage of some trees, as the yew, may also cause gastritis.

Symptoms.—When gastritis accompanies impaction of the stomach, there are no diagnostic symptoms by which these conditions may be distinguished. In most cases great abdominal pain, acceleration of respiration, and a quick, rather hard, wiry pulse are among the chief symptoms of acute gastritis.

For the special symptoms of the different poisons we must refer the reader to the chapter on toxicology.

Morbid Anatomy.—The changes in the mucous membrane of the stomach vary in character and extent with the nature of the cause. When following continued irritation induced by dietetic errors, the mucous membrane is found to be opaque, swollen, and congested.

Treatment.—If acute gastritis be diagnosed, we should endeavour, in the first place, to ascertain the cause. If any poison has been administered, it will be necessary to treat the inflammation in accordance with the nature of the toxic agent, and to administer the requisite antidote.*

Under any circumstances the food should be very restricted in amount, consisting of linseed gruel, or other non-irritating food, in small quantity. Opiates may also be given, especially if there be much pain.

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* *Vide* Chapter on Poisons.

2. **CHRONIC GASTRITIS.—Etiology.**—Chronic gastritis may be met with as the sequel of acute inflammation, but it usually follows dietetic errors.

In some instances it is traceable to irritation, caused by the presence of the larvæ of the œstrus equi, and may result from disease of the liver, or be dependent upon malignant disease of the walls of the stomach.

Crib-biting is also not unfrequently a cause of dyspepsia and chronic gastritis.

Symptoms.—The symptoms, for the most part, are those of chronic dyspepsia, which, though often spoken of as a functional disorder of the stomach, is frequently due to chronic inflammation of that viscus.

Some cases of frequently recurring colic and intestinal disorder are, no doubt, to be attributed to chronic gastritis.

Treatment.—Ascertain the cause, if possible, and restrict the diet.

The internal treatment will vary with the cause, but will in the main be similar to that recommended in chronic dyspepsia.

RUPTURE OF THE STOMACH.

Etiology.—Partial or complete rupture of the walls of the stomach is not uncommon among horses. It is mainly due to errors in dieting and work, and is more frequently met with among the heavier draught horses, which are especially subjected to irregularities of work and defective dietetic arrangements.

Rupture is especially likely to occur when a large amount of food is given after exhausting or prolonged work. Under these circumstances the food is especially liable to undergo fermentative changes from its longer retention in the stomach, owing to the slow and imperfect action of the gastric juice and the defective muscular movements of the walls. It is said to be more frequent in horses fed on bruised than on whole grains, especially when put to work after a full meal.

Rupture of the stomach is probably, in most instances, preceded by derangement and distension, or actual degeneration of the walls, consequent on chronic indigestion and other causes. It is rarely met with in young animals, but most commonly occurs in aged animals, especially when these have undergone severe exertion or have been overworked for a long period.

Symptoms.—Vomiting, or attempts at vomiting, generally occur in rupture of the stomach, but as it is not invariably present, and may proceed from other causes, as, for instance, from rupture of the colon, or other part of the intestine, and also from dilation of the cardiac orifice, it cannot be considered a diagnostic symptom. We have often met with cases of rupture when there has been no attempt at vomiting. It is, however, more complete in rupture of the stomach, and in dilatation of the cardiac orifice, than in intestinal lesions. Rupture may be brought about by gradual distension of the walls, and without much pain, until the advent of peritonitis, which is set up by the escape of the contents of the stomach into the peritoneal cavity. Sometimes, however, rupture occurs suddenly, owing to the violent struggles of the animal in its paroxysms of pain, during the course of gastric disturbance, or in intestinal disorders.

The animal becomes uneasy, the countenance becomes gloomy and dejected, and he looks anxiously round at his flanks. There is great weakness, and rapid prostration of strength. The pulse is feeble and fluttering, the respirations are short and quick, and there are frequent attempts at vomiting and regurgitation of the solid or fluid contents through the nostrils, and there may be profuse perspiration. In some cases the animal remains quiet for a time after the rupture, while in other instances the pain is intense, and the animal becomes delirious.

By some vomition is thought to be incompatible with rupture of the stomach, and is considered to be an antecedent symptom. It is, however, highly probable that vomition can and does occur after rupture of this organ, unless the rent be very extensive. There is a manifestation of continuous pain, and the countenance is expressive of intense suffering. At times the animal will show evidence of pain by rolling on the floor of his stable, alternately striking the ground with his heels and throwing his head backwards with great violence upon the ground or other portions of the stable. At intervals profuse perspiration usually occurs, and from the very first the animal seems to be totally unconscious of anything beyond the pain from which he is suffering. The pulse is of a feeble character, fast, and fluttering; the respirations are taken in short, quick gasps, and the expirations especially are distinctly audible. In some cases vomition may occur; but this symptom is not invariably present. In cases of rupture of the stomach, all remedies prove incapable of relieving the pain.

Prognosis.—Rupture of the stomach is fatal in the great majority of instances. In some, collapse and death follow in a few hours, while in others, where the rent is not so extensive, life may be prolonged for a couple of days or more.

Treatment.—Treatment is of no avail. If the diagnosis is clear, it is best to have the animal put out of his agony.

SECTION IV.

DISEASES OF THE INTESTINES.

ON SOME IMPORTANT SYMPTOMATIC CONDITIONS AND FUNCTIONAL DISORDERS OF THE INTESTINES.

CONSTIPATION.

Constipation, or torpid action of the bowels, may depend upon intestinal obstruction, which is treated of below, or upon diminished peristaltic action, or deficient intestinal secretions. The two latter are, in their turn, chiefly due to dietetic errors, though they may depend upon other causes also. Retention of fæces, if not relieved, may lead to congestion or inflammation of the intestine, and death may occur from this cause within about five to six or seven days.

Generally the abdomen is full and distended, but this is by no means a constant symptom. The motions are attended with difficulty, and straining or tenesmus is not unfrequent, and colicky pains may be manifested.

If the constipation continue unrelieved, the appetite becomes impaired, weakness follows, and the pulse becomes feeble and accelerated. In some instances a yellow gelatinous mucous secretion is discharged in cases of constipation depending upon retention and impaction of the fæces. This discharge is frequently mistaken for diarrhœa by the uninitiated, when in reality it is indicative of a costive condition of the bowels.

Treatment.—As long as the animal remains in good health all that is necessary in cases of mild constipation, or when the bowels are but slightly costive, is a change of the diet for one of a more laxative nature. If this costive condition is habitual, a moderate dose of aloes, followed by the administration of vegetable tonics, such as nux vomica, gentian, and several others, is efficacious in most instances.

When the irregularity of the bowels is dependent upon paralysis of part of the intestine, purgatives should not be given. In these cases, stimulants, with liquor strychniæ, will be found very beneficial. If the paralysis involve the large gut, the rectum is frequently found to be in a dry, dilated condition, and gives the impression, when the hand is introduced, of a large cavity with passive walls (Williams).

For the prevention of the recurrence of constipation bran mashes and other laxative diet may be substituted occasionally for the more solid food, and nux vomica, gentian and ginger may be given in the form of a ball three or four times weekly. If necessary, an occasional dose of aloes may be administered. In cases of acute constipation when ordinary purgatives have failed, it is best to have recourse to an intravenous injection of sulphate of eserine in a half-grain or even a one-grain dose.

In cases where young foals are unable to void the meconium, enemas of oil will generally be found efficacious. If the bowels are not relieved by this means, a couple of ounces of castor-oil may be given internally.

In the year 1886 we were called to a cart-mare on a farm near Louth. She had been suffering from colicky pains and complete constipation for three days. The owner had administered three pints of linseed-oil and two pints of castor-oil. Enemas were ordered, and eight drachms of aloes and one drachm of calomel were given. The mare was heavy in foal. Even on the fifth day no relief had been obtained. The pulse was eighty-seven, and the respirations were accelerated. We gave an intravenous injection of solution of sulphate of eserine (twenty minims containing one grain of the salt, as prepared by Wright, Layman and Umney). Beyond producing extreme tenesmus and violent muscular tremors, no action of the bowels except the evacuation of a small quantity of fluid mucus and a few small hard lumps of fæcal material was brought about. In six hours' time the injection was repeated, with the result that copious evacuations were made, and the mare made a complete recovery.

The following remarks on intravenous injections in cases of constipation, written by ourselves, are taken from the *Veterinary Journal* for 1886, vol. xxiii., page 168:

'In no branch of the veterinary art has there been such marked advance of late as in that of therapeutics, and it is highly satisfactory that in this department rapid progress is still being made almost daily. We are of opinion that in whatever degree our Continental brethren may have stepped beyond us in the pathological branch of our art, the English veterinary surgeons, at any rate, have stood behind none in their therapeutic knowledge and its application to everyday practice. It is, however, not my purpose now to enter into a general disquisition on the therapeutics of veterinary medicine and surgery, but to say a few words regarding the action of sulphate of eserine on the bowels. I may first say that I have tried this drug hypodermically, as recommended by Dieckerhoff, and have invariably found it to be of little or no effect. When injected intravenously, however, the results have in each case been highly satisfactory.

'On May 19, 1886, a six-year-old strong draught-horse was affected with colic, due to obstinate constipation. We were called in to see it on the 20th, and gave a six-drachm aloes-ball. At 4 p.m. on the 21st there was no relief. The pulse was 96. The pain was almost continuous. From the foreman's calculations there had been no passage for three days. One grain of sulphate of eserine in solution was administered by intravenous injection into the jugular vein. In eight minutes there was extreme pain. The horse broke out in twenty minutes' time into profuse perspiration. There were marked muscular tremors. At the twelfth minute after the injection, hard fæces together with fluid were passed. Violent straining continued for the next twenty minutes, during which time the animal voided no less than eight discharges of alvine material, several of the latter being quite fluid. The tenesmus and grunts were intensely extreme. Muscular tremors increased up to half an hour after the injection, after which time the animal became quiet, and ate some mash, and the pulse went down to 60.

'On leaving, further action was prevented by the administration of an opiate draught. The horse made a complete recovery.

'We have also used this valuable salt in cattle. A cow had been constipated for four days, and had during that period absolutely no passage. She had received four doses of Epsom salts, linseed-oil, castor-oil, aloes, calomel, and other aperients. Half a grain of sulphate of eserine was injected into the jugular vein, with no other result than pain manifested by frequent moanings, gurglings in the bowels, and restlessness. After an interval of half an hour, three-quarters of a grain of the salt was injected. In nine minutes the cow passed hard lumps and fluid fæces. On the following day, three-quarters of a grain was again injected, with good results. The animal had two or three passages afterwards during the day, and then made a gradual but complete recovery.

'We have tried it in three or four other cases, and find that unless from three-quarters to one grain is given, and that by intravenous injection, little or no action is produced. It is well to bear in mind that this drug should never be given except in very severe cases, as the action usually induced by it is so extremely excessive.'

DIARRHŒA.

Etiology of Diarrhœa.—Diarrhœa is the general term applied to abnormal fluidity and increased amount of the alvine discharges. It is met with as a functional disturbance of various nature, or as a symptom in the course of general disease or extensive local changes in the intestinal tract.

The proximate causes of diarrhœa are excessive secretion from the intestinal walls, combined with increased peristaltic action. These conditions are, in their turn, either due to direct irritation of the mucous membrane from without, as, for instance, by food, foul water, parasites, or to indirect influences generated in the animal itself. As instances of the latter may be mentioned the diarrhœa which sometimes accompanies the specific fevers, and that which occurs in some structural changes in the liver, spleen and pancreas, and that resulting from disturbance of the nervous system, frequently reflex in nature.

Perhaps of all causes of diarrhœa, the most frequent in the adult animal is injurious and irregular dieting. Sudden changes in the diet, especially from a dry to a moist or laxative one, ingestion of medicinal substances, copious draughts of cold water; when heated after exposure to the sun's rays or exertion, and feeding immediately after severe work or exposure to cold and damp, may be mentioned as specially liable to induce diarrhœa.*

In plethoric horses with very little work, a small amount of exercise will often bring on an attack of diarrhœa.

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* Mr. Robertson mentions that diarrhœa is sometimes induced by the free use of potatoes; but this practice is fortunately limited to certain parts of the country.

Symptoms.—The fæces are semi-fluid, and either fœtid or without offensive odour. If the diarrhœa continues long unchecked, the animal loses flesh and the appetite fails.

In some instances, there is great prostration, abdominal pain is not uncommon, and the respirations become accelerated. Unless the nausea and pain be very marked, the pulse is not usually quickened. The special symptoms induced by the presence of parasites, among which the strongylus tetracanthus, a small nematode found chiefly in the cæcum and colon, is especially liable to cause diarrhœa, will be considered in the chapter on parasites.

Etiology, Symptoms, and Pathological Lesions of Diarrhœa in the Young.—In the young, diarrhœa in many instances differs from that of the adult, and has special characteristic features of its own.

The form of diarrhœa to which we refer is a specific intestinal catarrh, which though not contagious in foals, as it is probably in the bovine species, is nevertheless a far more serious affection than ordinary diarrhœa of the adult.

It owes its origin to defective sanitary arrangements, and also to changes in the quality of the milk. Such changes are traceable in some instances to the fact that the mare is worked hard during the day, and returns at night to her foal, which after its fast during the day is apt to take more milk than it can well digest.

The symptoms of this infantile diarrhœa usually appear during the first two or three weeks of life. The fæces at first are of a yellowish white colour, and there is little or no pain. In more advanced stages, or from the first in the more serious forms, the fæces are acrid, and there is more or less abdominal pain, which may be very severe. If the disease continues, the foal ceases to suck, and loses flesh rapidly.

After death there may be no discoverable lesions, or there may be an accumulation of dark serous fluid in the abdomen, as well as several patches of ecchymosis on the peritoneal surface of the bowel. The mucous membrane of the bowel is infiltrated, and covered with a catarrhal discharge, while in some places superficial ulcerations, owing to the removal of the epithelium, may be found.

In some instances the liver is pale and bloodless.

Prognosis in Diarrhœa.—The prognosis is usually very favourable, but in infantile diarrhœa a fatal termination is not uncommon.

Treatment of Diarrhœa in Adults.—We should, in the first place, endeavour to ascertain the cause of the diarrhœa. If it proceed from irregularities in the feeding or in the work, these should be immediately rectified. In most instances medicine is not required unless the diarrhœa is excessive, or the pain and general disturbance very great. No cold water should be allowed; the animal should be kept quiet and warmly clad. The diet should be easily digestible, and linseed gruel or other demulcent drinks may be allowed. When the pain is very great, tincture of opium, spirits of chloroform in moderate doses, with a drachm of camphor, may be given three times daily in flour gruel. When prostration is very marked, and the pain severe, tincture of opium, sulphuric ether, and spirit of chloroform may be given three times daily, with a moderate amount of alcoholic stimulant, as port wine or brandy. Woollen cloths wrung out from warm water may be applied frequently to the abdomen, and stimulating liniments rubbed in in the intervals between the applications. When the diarrhœa is due to hepatic engorgement or obstruction to the portal circulation, diluted nitric acid, with nux vomica and gentian, may be administered in the form of a draught twice daily.

Treatment of Diarrhœa in the Young.—It is well to commence the treatment of this form of diarrhœa with a laxative, such as castor oil, in order to expel irritant matter in the intestines.

A dose of tincture of opium may be given with the oil.

This treatment may be followed up by the administration of camphor and opium, with spirits of chloroform, three times a day, in water, or in strong decoction of tea.

When weakness is very marked, a little alcoholic stimulant may be added, and the hot cloths and stimulating liniments applied to the abdomen. Other remedies also found beneficial are carbonate of magnesia, catechu, Bael fruit and prepared chalk. Pepsin 5 to 10 grains together with 20 minims of diluted hydrochloric acid, given about twice daily, is a very useful mixture for diarrhœa in young foals which are suckling.

COLIC.

Abdominal pain may arise from functional derangement of the intestinal canal, or it may be due to organic lesions of varying extent and nature. To the functional disturbance the term '*true colic*' is applied; while when depending on organic lesions this condition is sometimes spoken of as '*false colic.*'

True colic is of two varieties, which may be associated together. The one, termed 'spasmodic colic,' is due to spasmodic contraction of the muscular walls of the gut; the other, termed 'flatulent colic,' is owing to extensive gaseous accumulation in the intestine. It is said that the spasmodic form may terminate in intestinal inflammation. This is not at all improbable, but *nevertheless it is not easy to tell in such instances whether the colic may not be an early symptom of commencing inflammation.*

Etiology of Colic.—Colic may be due to dietetic errors, such as have been already mentioned as liable to induce dyspepsia, diarrhœa, constipation, and other disordered states of the system. Over-feeding, sudden changes in the diet, irregularities in the dieting, taking a large amount of food after a long fast, or after prolonged or severe exertion, food of inferior or unsuitable quality, are all potent agencies in the production of spasmodic intestinal contraction, as well as of flatulent distension, which may be associated with the spasm or occur independently.

Besides dietetic errors, there are many other causes of colic. This painful affection may be due to intestinal obstruction from mechanical displacement, and change of position of different parts of the intestine, or from impaction of calculi or other concretions of varying composition.

Not unfrequently colic depends upon the presence of animal parasites in the bowels, and sometimes also in neighbouring parts. Young animals especially, when badly fed and attended to, are more liable to colic from this source than older horses. Pain, when originating from the presence of worms, is usually of a recurrent type, and attended with progressing debility and loss of flesh. The presence of certain worms in the mesenteric arteries is, as we shall see in the chapter on parasites, also said to be a frequent cause of colic on the Continent, more especially in Germany. This parasitic affection, which is rarely met with in this country, sometimes even ends in death. Irritant poisons, when ingested, produce pain, sometimes very intense. Cold and damp also may cause intestinal disturbance, manifested by abdominal pain.

Lastly, as causes of colic are the group of organic diseases not only of the intestine itself, but also of the peritoneum, kidneys, liver, and pleura.

Among the organic diseases which may produce colic are:

disease, more especially abscess, of the mesenteric glands, which not unfrequently accompanies strangles and other suppurative diseases; chronic changes in the walls of the intestines, as, for example, thickening, degeneration or atrophy of the coats; malignant growths; intussusception and dysentery.

Symptoms of Spasmodic Colic.—The onset of spasmodic colic is generally more or less sudden. The horse shows signs of abdominal pain by looking round at his flanks, by restlessness, by striking at his belly with his hind feet, and in various other ways. He lies down, and rolls about from side to side. After a while he rises and eats a little, and soon perhaps a paroxysm of pain again attacks him.

In uncomplicated cases of colic the number of the pulse and respirations and the temperature are rarely elevated, except during the paroxysms of pain. The pulse is then much accelerated, and the respiration becomes hurried or sighing.

The attack may now subside, or gradually become more and more severe, the paroxysms becoming more continuous and the pain more intense.

The restlessness and excitability increase, or partial stupor supervenes, and the attack, if unrelieved, may end in death from continued pain or exhaustion, with varying complications.

In most cases of colic the bowels are constipated, and the fæces, if any are passed, are usually hard, and often coated with mucus. The urine is frequently retained, or passed in a jerky manner. Great restlessness, much pain, frequent pawing and looking to the sides, are said to be especially indicative of invasion of the small intestine, while stretching of the body, throwing of the head upwards, with curling of the upper lip and pressing of the posterior part of the body against the wall or stall-post, more especially point to colic resulting from impaction of the large intestine.

Symptoms of Flatulent Colic.—Flatulent colic, due to distension of the intestine with gas, may be associated with spasm of the muscular coats, or it may occur independently of the spasmodic variety. The flatulent form is especially to be attributed to digestive disturbance depending on ingestion of food specially prone to undergo fermentation. This affection usually comes on suddenly. The horse is noticed to be very restless, and the abdomen distends and becomes tense, and gives a tympanitic note on percussion. The breathing is short, and chiefly thoracic, and the pulse is increased in frequency, and feeble. The extremities are cold, and there may be more or less delirium and vertigo. When the animal is inclined to lie down, he does not throw himself suddenly on the ground, as in spasmodic colic, but allows himself to fall more slowly and carefully.

If unrelieved, the continued distension and thoracic compression may lead to further circulatory and inspiratory disturbance, and death may result from asphyxia. Sometimes rupture of the colon or other part of the bowel, or of the diaphragm, is the cause of death.

Prognosis of Spasmodic and Flatulent Colic.—In severe cases of flatulent colic the prognosis is not so favourable as in the spasmodic form, but in ordinary cases the prognosis is very favourable in both varieties.

In all prolonged cases with great pain and restlessness there is danger of displacement or entanglement of the intestine; and when tympanitic distension is very great, or the struggles very violent, there is great risk of rupture of the large bowel or of the diaphragm.

Morbid Anatomy of Spasmodic and Flatulent Colic.—When colic is due to continued spasm, there may be found a peculiar degenerative change of both the mucous and submucous walls of the small and large gut. In other cases the change is of an atrophic nature.

In many instances, however, no change is to be found in the walls of the intestine, though these are not infrequently somewhat thickened.

In some cases parasites, or various kinds of concretions to which the pain was due, may be found after death.

When the colic depends on organic changes, corresponding lesions of varying extent are found.

Treatment of Spasmodic Colic.—In all cases of colic, except those in which diarrhœa is present, it is advisable to commence treatment by the administration of a cathartic. Barbadoes aloes is the best purgative in these cases, and is given preferably in the form of a ball, in doses of 5 to 7 or 8 drachms, depending upon the size and condition of the animal.*

In addition to the cathartic, enemas of water at about 100° F. should be given, and repeated at intervals of two or three hours if necessary. Some recommend the addition of aloes to the enema, or the substitution of oil for warm water in cases of impaction of the colon. If the pain is severe, it is best combated by the administration of ℥i. ss. to ℥ii. of sulphuric ether with ℥ii. of nitric ether, which may be given in gruel or water, and may be repeated every two or three hours in the early stages so long as the pain continues unabated. Tincture of opium, or hypodermic injection of 40 minims of acetate of morphia (injectio morphinæ acetatis, B.P.), is recommended by some authorities. These opiates are also very efficacious in subduing the pain. The tinctura opii may be given in ℥ij. to ℥iij. doses, and may be repeated if necessary after the lapse of two or three hours. It is not, however, generally necessary to repeat the hypodermic injection. A mixture composed of doses of tincture of opium and sulphuric ether, with a moderate dose of spirit of chloroform, is perhaps the most efficacious means of subduing the intense pain of colic. Some recommend Fleming's tincture of aconite; but we believe this remedy to be neither very efficacious nor necessary in the treatment of uncomplicated colic.

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* There is perhaps no drug in the pharmacopœia of which such varying qualities are found in the market as of Barbadoes aloes, and none in the buying of which greater care is required. Much of that sold is really unfit for use; and it is well not to trust to balls of aloes sold ready made up by some. We believe that neglect of proper precautions in this particular is often answerable for very untoward results.

Hot fomentations and stimulating liniments may with advantage be applied to the abdomen.

Treatment of Flatulent Colic.—In these cases, in addition to the aloes, it is advisable to administer some remedy to dispel the accumulated gas. For this purpose, aromatic spirit of ammonia, turpentine, and asafœtida are perhaps the best. If there be much pain, an anodyne, as sulphuric ether, or tincture of opium, should be administered in addition. The use of a very fine trochar about six inches long is often of great value in cases of extreme intestinal distension.

French veterinarians largely practise puncturing the colon with a trochar, in order to liberate the accumulated gas. This measure is said by some to be attended with great benefit if performed early. In both spasmodic and flatulent colic the intravenous injection of sulphate of eserine is a very valuable measure to adopt.

INTESTINAL OBSTRUCTION.

Etiology.—The causes of intestinal obstruction may be arranged under various headings:

1. *Causes acting within the gut itself*, such as impaction of fæces, or concretions of various kinds. Some of the latter are composed of vegetable matter, while others chiefly consist of mineral substances, as phosphate of lime and magnesia. Stones of an immense size are sometimes found in the large intestine, and also hair-balls may be present.

The larger concretions are more frequently found in the pouches of the large intestine, from which they are liable to be displaced by the movements of the animal.

2. *Causes acting on the walls of the gut*, as inflammatory thickening, or stricture of any portion of the small or large intestine. These causes are rare in the horse.

3. *Causes acting on the gut from without*, resulting in altered position or displacement. As examples may be mentioned strangulation by bands of lymph, or, in rare instances, by mesenteric tumours, the neck of which wraps round the gut, and also twists and displacements of various kinds.

The colon may be found twisted round on itself, and sometimes the small intestine is entangled, owing to twisting or laceration of the mesentery. Not uncommonly a loop of the small, and sometimes of the large, intestine passes through an opening in the peritoneal covering.

Umbilical and inguinal herniæ may also cause obstruction, as also may *intussusception, or the passage of one part of the bowel into that immediately below it.* This condition is very rarely met with in the horse, and is of more frequent occurrence in the young than in adult animals.

General Symptoms of Obstruction.—The symptoms of intestinal obstruction, which may proceed from so many different causes, are very variable.

When the obstruction results from impaction of fæces, or from the presence of concretions, the symptoms are usually gradual and of an intermittent character.

The other forms are generally more sudden in their onset; but we know of no diagnostic symptoms peculiar to twists, intussusception, or strangulation of the intestines in the horse.

All of them may be associated with great enteric or abdominal pain, restlessness, sitting on the hind-quarters, small, frequent, thready pulse, accelerated respiration, cold extremities, distension of the abdomen, and collapse, ending in death from exhaustion.

In some cases it may be possible to detect an external hernia, when the diagnosis will be at once cleared up. The progress of the case will sometimes help us in forming a diagnosis; for example, if there be constipation, with frequent attacks of colic, the obstruction is probably due to impaction of fæces.

The following is a brief record of a very interesting case which occurred quite recently in our practice:

A horse was first seized a year ago with a violent attack of intestinal irritation or disturbance, or inflammation. The bowels were costive, the pulse was accelerated, as also were the respirations, and in addition the symptoms of acute abdominal pain were manifested. A cathartic ball was given, and also two fluid ounces of tincture of opium; anodyne drenches were administered at intervals of four hours. The bowels were opened within a period of forty-eight hours, and the animal made a rapid recovery.

The horse had numerous attacks of colic during the next year. One year afterwards the horse was seized with a more severe attack of constipation, coupled with inflammation and acute pain. The horse was much disturbed, as is generally the case. Similar treatment was adopted, but the bowels were not opened, and the animal died about three days after the seizure. On a post-mortem examination being made, about two stones of sand were found to be present in the colon near its junction with the floating colon. It was supposed that the horse obtained the sand from oats with which a great deal of sand was mixed.

Treatment of Obstruction.—Anodynes, such as those recommended in colic, may be given, and repeated as often as necessary. Tincture of opium and sulphuric ether are perhaps the most efficacious. Enemata of warm water may be injected in full amount into the rectum, and hot fomentations, or woollen cloths wrung out from hot water, applied to the abdomen. The rectum may be explored also by the hand, with the object of removing obstructions when within reach.

In some instances tapping the distended bowel is recommended when the distension is very great.

The food should be of a laxative kind, and only allowed in moderation.

RUPTURE OF THE INTESTINE.

Rupture of the walls of the intestine is of more frequent occurrence in the colon than in the small intestine, and is due in most instances to impaction of fæces, or to excessive tympanites, or to both these conditions associated together. It is readily intelligible that these disorders are especially liable to result where the walls of the gut are in an atonic or degenerated condition. Moreover, under these circumstances the muscular and other coats of the intestines are least capable of resisting the effects of these disorders, and are thus especially prone to rupture.

Symptoms.—The symptoms of rupture are very variable, and not diagnostic. In most instances rapid exhaustion follows the intestinal lesion, wherever it may be situated.

In some cases collapse and death soon follow the occurrence, while in others life is not extinguished for several days. In many cases rupture is very difficult to diagnose from other severe affections of the bowels. When following impaction of fæces in the colon, or considerable dilatation of the walls of the gut, rupture is not unfrequently succeeded by relief. The restlessness and straining subside, and a period of calm follows until death. The countenance, however, is anxious, the pulse small, thready, and gradually becomes more and more imperceptible, the respiration is short and thoracic, and there is great disinclination to stir. In rupture of the colon the horse frequently sits on his haunches, and may attempt to vomit; but these symptoms cannot be regarded as diagnostic of rupture. Sitting on the haunches, indeed, is a very frequent symptom in twists and other forms of strangulation.

ENTERITIS — INFLAMMATION OF THE BOWELS.

Etiology and Varieties.—Inflammation of the bowels is in most cases limited to sections of the intestinal canal, though it may affect the tube throughout. It is more commonly met with in adults and in those in confinement than in the young and those running out at grass.

The late Mr. D. Gresswell used to recognise two distinct forms of enteritis in the horse, which, although presenting many symptoms in common, are in reality of a different nature.

The first variety may be termed *congestive*, or indeed *apoplectic*, from the rapidity with which the animal is struck down, as it were, and dies in a few hours. However, an animal thus afflicted may live for twenty-four hours. Of this variety the causes are not always apparent, but over-exertion, prolonged exposure to cold, drinking cold water when heated, and, finally, washing with cold water while the animal is in a heated and perspiring condition, are among the chief with which we are acquainted.

The second variety, which may be termed *secondary enteritis*, is in most instances of not such a severe type, even though the extent of inflammation is in some cases very great. This form depends upon impaction of fæces, constipation, intussusception, the ingestion of irritative poisons, especially arsenic, various concretions, aggregations of parasites, and various other causes.

In addition to the above causes, enteritis may also supervene in some fevers and constitutional diseases. As an example may be mentioned the enteritis of pink eye, or pneumo-enteritis, as this form of influenza has been termed.

By some the cæcum and colon are said to be more frequently invaded than the small intestines, while other authorities affirm that enteritis has its seat more frequently in the ileum and jejunum.

Symptoms.—In some cases the symptoms of enteritis are gradual, while in others they are sudden in their onset. Not unfrequently the abdominal pain is preceded by general constitutional disturbance, shown by acceleration of the breathing, marked dulness, depression, and loss of appetite; while in other instances the inflammatory action is ushered in with marked shivering or rigors.

The belly is generally tender when pressure is applied.

The abdominal pain, unlike that of colic, is continuous, is more agonizing, and rarely has periods of intermission.

The pulse, at first quick, hard, and wiry, becomes in the later stages still more accelerated, though of less volume, feebler, and gradually more irritable and imperceptible. In number the beats range from 70 or 80 to 120, or even higher.

In cases of simple colic the pulse is unaltered, except during the paroxysms of pain, whereas in enteritis it gradually becomes more and more disturbed.

The animal in his paroxysms of pain stamps and strikes at his belly, and when he lies down he may be observed to do so with greater care than in simple colic.

He often turns his eyes towards his flanks, and copious sweats bedew the body, and he groans in his agony. At other times he stands, so intense is the pain, almost motionless, with an expression indicative of acute suffering depicted on his countenance.

The surface of the body becomes cold and bedewed with moisture, the pupils dilate, and stupor may supervene.

The respirations are quick, short, sharp, and the expiratory action is accompanied by a short, quick gasp, which is very audible, and in the last stages of the disease very characteristic.

The animal soon perhaps becomes more restless than ever, and wanders about the box, or casts himself down, and rolls about regardless of all obstacles.

Sometimes he will balance himself for a short time, with teeth clenched and limbs and ears icy cold, when he may suddenly fall, and die exhausted after severe struggles.

Sometimes before death an apparent improvement takes place ; the horse stands quiet for a while, yet, though the breathing becomes quieter and the pain abates, and he takes a little food, the countenance maintains its haggard, dejected appearance, cold sweats bedew the body, and the pulse continues thready, and perhaps almost or quite imperceptible.

In still more advanced stages, if agony, pain, and intense inflammation have not already carried off our patient, he trembles continuously, the lips fall pendulously, the eyes become duller and more amaurotic, the mouth becomes clammy, the breath perhaps fœtid, until at length he can hold out no longer, and death puts an end to his suffering.

Prognosis.—Enteritis is generally fatal. If, as happens in some rare instances, the acute symptoms abate after the lapse of a few hours, and the pulse regains in some degree its normal character, becoming fuller, softer, and slower, there is great hope of recovery.

Morbid Anatomy.—In the form of enteritis which we spoke of as congestive, the post-mortem appearances are very marked and characteristic.

The mucous membrane of the affected section of the gut is intensely congested, being of a deep purple or even black colour, and in many instances there is a copious effusion of blood in the intestinal canal. The mucous coat is much thickened, and can be easily separated from its connections with the underlying coats of gut. There is also considerable thickening of the submucous and subserous coats, which are intensely infiltrated with sero-hæmorrhagic effusion.

The colon is said to be more frequently the seat of this violent form of inflammation than any other part of the bowel.

In some cases, so extensive is the infiltration and thickening of the submucous tissue, and so intense is the inflammatory process, that this coat appears as a dark purple or black gelatinous mass of two inches or more in thickness, extending for varying lengths of the gut, and sometimes involving many feet of the intestinal tract.

Even though the amount of effusion into the gut be very great, and the contents themselves be fluid, the bowels usually remain inactive owing to paralysis of the muscular coats.

In other forms of enteritis the inflammatory process is not of this marked character. The inflammation is usually more patchy in distribution. Coagulable lymph is effused on the surface, and afterwards may be voided with the fæces. The morbid appearances of enteritis caused by the ingestion of poisonous agents will be considered in a later chapter.

Inflammation of the intestines, which occurs in various fevers, such as influenza, is of a different character from the varieties already considered. In some instances the inflammation is attended in these cases with extensive sero-hæmorrhagic effusion into the submucous coat, while in others the exudation is a much less marked feature.

Sometimes ulcerated patches are observed in the mucous membrane, while in other cases the epithelial lining of the intestine is eroded in large tracts, leaving a rough granular surface. Not uncommonly dark gangrenous patches are encountered here and there on the mucous membrane.

Treatment.—We have said that in acute enteritis cessation of the peristaltic action results at the seat of the inflammation owing to paralysis of the muscular coats of the intestine. It is thus manifest that cathartic medicines, if administered, would cause increased peristaltic action and secretion above the seat of disease. They would thus only serve to further increase the irritation in the involved area by the passage of the fæces through it, while they could have no effect whatever on its functional activity, owing to the paralysis of the walls.

Furthermore, constipation, lasting a day or two, is not in itself a matter of very serious importance. Cathartics are therefore inadmissible in the treatment of this disease, being only calculated to promote the morbid processes in action. So far from our irritating the inflamed intestine for the relief of constipation, we should use all the means in our power to assuage pain and calm the movements of the intestines. For this purpose no remedy is more efficacious than opium, or its alkaloid, morphia. Opium is best given in powder in the form of a ball, or in simple solution, and may be administered in doses of one, two, or three drachms in a suitable medium. Some authors recommend a draught of five minims of tincture of aconite, and half a drachm of opium. We prefer to give a larger dose of opium in the first instance, and have found that the addition to the mixture of two drachms of chloroform considerably enhances the beneficial result. Aconite is, however, also a valuable remedy in the treatment of enteritis, especially in those cases where bleeding, though admissible, is not practised.

After the administration of the opiate, if the pain still continue severe, 40 minims of the injectio morphinæ hypodermica (B.P.) may be injected under the skin every two or three hours if necessary.

Some veterinary surgeons prefer sulphuric ether for the relief of pain after the administration of the opiate, while others combine the two remedies. Sulphuric ether is without doubt a valuable remedy, especially in all cases where there is much flatulence, and we have found it of great value when given in addition to the hypodermic injection. Of the use of belladonna as a drug to be depended upon in enteritis, we cannot speak in high terms of praise.

Hot fomentations, by means of woollen rugs wrung out from very hot water, may be applied to the abdomen, and renewed every half-hour for three or four times, while the pain is very acute, and afterwards every hour or so. During the intervals some stimulating liniments may be well rubbed in, over the abdomen. Some practitioners recommend the application of a poultice of mustard, which is rubbed off in two or three hours, and followed up by the application of hot fomentations.

Enemas of tepid water should be given by means of the ordinary funnel apparatus, but it is not advisable to use any injecting syringe. If the enema cause much pain, it is well not to annoy the animal by continuing it. If the horse is inclined to drink, he may be allowed linseed gruel or tea, or oatmeal gruel.

After the abatement of the acute symptoms, no cathartics should be given, but we should endeavour to relieve the bowels by the administration of enemas and laxative diet, consisting of bran mashes, linseed, and oatmeal gruel. No hard food should be allowed on any account until all danger is over.

In highly plethoric animals, bleeding is indicated in the early stages, when the pulse is full, and is often very shortly followed by abatement of the acute symptoms. Blood should be abstracted in amount proportionate to the size and condition of the animal, and in moderation only.

It is our practice under any circumstances not to remove more than two or three quarts of blood.

The operation should not be repeated.

DYSENTERY.

Definition.—Dysentery (δυς, with difficulty; ἐντερον, the bowel) is an inflammatory disease of the intestine, chiefly the large one, accompanied by febrile manifestations and sometimes by abdominal pain, and is characterized by certain tissue changes which vary according to the intensity of the inflammatory process. The fæces are often mingled with blood, albuminous material, or shreds of disintegrated tissue.

Nature and Etiology.—Dysentery is of less frequent occurrence in the horse than in other animals, and may be of an acute or chronic nature. It is not established as yet whether this affection can be communicated from one horse to another. In most cases dysentery occurs as an independent affection; sometimes, however, it supervenes on an attack of ordinary diarrhœa. Among the chief causes of this malady in the horse are:

1. *Malhygienic conditions*, such as overcrowding, vitiated air supply, and exposure to noxious emanations.
2. *Insufficient or bad food and foul water.*
3. *Exposure to cold and damp, overwork, and all other depressing agencies.*
4. *Malarial poison* arising from vegetable decay.

This is especially prevalent in low-lying marshy tracts and in shady places.

We have, as yet, no evidence that dysentery owes its origin to the entry of any specific germ into the system, already perhaps in an unhealthy depressed condition, but this seems not at all unlikely.

In the horse we have no proof that this disease ever arises from direct infection from another animal.

Symptoms.—The frequent passage of liquid fæces may first attract notice, or, in other instances, febrile manifestations, debility, and rapid prostration may precede the frequent alvine discharges.

Rigors are common throughout the disease in many cases. The pulse is accelerated, the internal temperature is elevated, thus distinguishing this affection from simple diarrhœa.

Sometimes the disease begins insidiously, and we may not suspect the true nature of the affection in the first instance. But as the disease advances the appetite becomes more impaired; there is great depression, thirst, tympanites not unfrequently, general wasting, marasmus, and marked prostration.

The fæces are thin and watery and offensive, and are sometimes voided with abdominal pain, and there is much straining and irritation about the rectum and anus.

If examined, the alvine discharges are observed to be made up of mucus, blood in varying degrees of coagulation and decomposition, small portions of indigestible matter, shreds of sloughing mucous membrane, and but very little true fæcal matter.

Prognosis.—In mild cases the prognosis is favourable, but in severe ones there is very little hope of recovery.

Morbid Anatomy.—Dysentery consists in inflammation of a diphtheritic character, being characterized by the formation of a greyish fibrinous material on the surface of the mucous membrane.

The large intestine is generally involved, the small being rarely affected.

The inflammation is at first of a patchy character, and may have a favourable termination, or ulceration follows, and dark-coloured irregular sloughs of variable extent are formed.

Treatment.—In the treatment of dysentery it is at first necessary to attend to the sanitary conditions.

The animal should be kept at rest, and the diet should be of an easily digestible, fairly nutritious, moist kind.

A small dose of oil may be given in the first instance, and this should be followed up by the administration of opium and antacids for a time. If the progress of the disease is not arrested, astringents, such as tannic acid, alum, perchloride or sulphate of iron, catechu, and bael fruit, may be tried. Nitrate of silver in solution, sulphate of copper, or acetate of lead with opium in the form of a ball, are recommended.

In order to act as a deodorizer and antiseptic, carbolic acid or hyposulphite of soda are indicated. Ipecacuanha* given in combination with opium is also said to be of great value in the treatment of this disease.

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* Ipecacuanha is regarded as a specific in the treatment of dysentery in man.

SECTION V.

DISEASES OF THE PERITONEUM.

PERITONITIS.

Etiology.—Peritonitis (περιτεινω, I stretch around), or inflammation of the serous covering of the abdominal viscera and walls, is not a common disease in the horse, though it may be set up by a variety of causes.

Idiopathic or primary peritonitis is met with as the result of exposure to cold and damp, and is of greater frequency as a sub-acute or chronic disease than as an acute affection. It is not uncommonly observed in this sub-acute or chronic form in young horses from exposure and insufficient diet.

Traumatic peritonitis is the form which follows the infliction of wounds of the abdomen, and various surgical proceedings, as castration and operations for hernia.

Sometimes inflammation of the peritoneum occurs as the result of injuries from within, as rupture or perforation of the organs in connection with it.

As instances may be given rupture of the walls of the stomach or intestine, or of the liver, spleen, or kidney, or of an abcess or hydatid in the substance, or in connection with the various abdominal organs.

Sometimes peritonitis follows bursting of the bladder from over-distension.

General or localized peritonitis may also be set up by propagation of inflammation from the bowels, liver, uterus, and mammary glands.

Lastly, *secondary or sympathetic peritonitis* occurs in some general diseases, for example, in certain specific fevers and constitutional diseases.

Symptoms.—The symptoms of peritonitis are very variable.

Acute idiopathic peritonitis is usually sudden in its onset, whereas the sub-acute or chronic form is slow and insidious in the development and manifestation of its symptoms.

The animal shows signs of abdominal pain, is restless, and paws the ground with its fore-feet. The pulse is small and wiry; the respirations hurried, shallow, and thoracic, and the temperature elevated.

The abdomen is tender, sometimes exceedingly so, when pressed upon, and is sometimes tympanitic.

The appetite is lost, and ascites may be developed.

In peritonitis following the infliction of injuries, the abdominal pain is generally more severe than in the idiopathic form.

Prognosis.—When general, peritonitis is fatal in most instances.

Morbid Anatomy.—As in the inflammation of other serous membranes, the stage of congestion is followed by the exudation of lymph, with or without the effusion of fluid, and by the proliferation, or 'germination,' of the endothelial cells which line the free surfaces of the peritoneal membrane.

The membrane becomes thickened, not, as a rule, uniformly, but especially in localized areas, in patches or streaks.

The lymph effused is yellow, forming a layer of variable thickness on the surface of the peritoneum, and leads to adhesions between the opposed surfaces. The adhesions become more coherent by age. The fluid effused may be small in amount, or abundant, especially in some forms, and holds flakes of lymph in suspension. Sometimes it is purulent or contains blood.

Treatment.—In strong plethoric animals, blood may be abstracted in acute peritonitis, and internally Fleming's tincture of aconite, with full doses of opium, or the hypodermic injection of morphia is indicated in order to allay the pain, and to quiet the movements of the intestines.

Locally hot fomentations should be applied to the abdomen, and may be followed up by the use of stimulating liniments containing opium.

To the water or gruel which may be allowed freely to allay the thirst, solution of acetate of ammonium, or other saline medicine may be added. After abatement of the acute symptoms, half-drachm doses of digitalis with nitric ether, and solution of ammonium acetate may be given every three or four hours.

In chronic cases, good nutritious diet and careful attention to the sanitary condition are of first importance. Internally, vegetable and mineral tonics take the place of the bleeding and sedatives recommended in the acute form. If there be much abdominal pain, it may be combated by the administration of opium or morphia in small doses.

Stimulating liniments may be applied to the abdomen.

ASCITES.—**Etiology.**—The presence of serous fluid in the peritoneum is termed ascites (*ἀσκος*, a leather bag, or wine skin). This condition is often associated with anasarca, or general dropsy, and may be due to a variety of causes:

1. Chronic peritonitis.
2. Disease of the walls or valves of the heart.
3. Obstruction of the portal circulation, from disease of the liver.
4. Renal disease.
5. Enlargement, or other disease of the spleen.

6. Deposits and new formations on the omentum or mesentery.

Symptoms.—The symptoms are insidious when unassociated with some special disease.

The animal is dull, listless, loses flesh, and becomes weak and debilitated.

The abdomen becomes gradually and uniformly distended, and if there is much fluid present, dulness is manifested on percussion, and fluctuation may be felt.

The animal loses his appetite, and the pulse is weak and accelerated.

The symptoms, however, will vary much with the conditions on which the effusion depends, and in many instances œdema of the limbs and lower parts of the body follows.

The urine is scanty, and if the kidneys are diseased, contains albumen in greater or lesser amount. If the liver is at fault, the urinary secretion may contain bile-salts and bile-pigment.

Morbid Anatomy.—In many instances there is more or less thickening and structural change in the peritoneum. These changes are especially marked in ascites, resulting in chronic or sub-acute inflammation of the peritoneum.

In some cases there is no detectable change found in this membrane after death. In ascites depending on disease of the heart, liver, or spleen, or on morbid growths in connection with the peritoneum, lesions, varying with the nature of the affections, are found in the organ at fault.

The fluid varies much in amount. It is usually clear, slightly viscid, alkaline, of a yellow or green tinge, and contains a large quantity of albumen. When following inflammation, it is turbid and flaky.

Treatment.—The treatment of ascites chiefly depends upon the disease with which it is associated. We have already spoken of the treatment of chronic peritonitis, and have only to add that if the fluid effused still remains unabsorbed, preparations of iron and vegetable tonics, with diuretics and the occasional administration of some purgative, are called for, in order to promote the general health and aid in the absorption of the fluid.

The iodide of iron, or the liquor ferri perchloridi, are more especially beneficial under these conditions.

When the ascites is due to cardiac mischief, in addition to the special treatment of the heart itself, diuretics and hydragogue purgatives are indicated.

If depending on renal disturbance, stimulating diuretics are inadmissible. Under these circumstances, perchloride or iodide of iron is very beneficial.

When the amount of the fluid effused is very great, and does not diminish after the employment of medicines, *paracentesis of the abdomen* may be performed, and repeated, if necessary. This operation, however, rarely affords permanent relief.

MORBID GROWTHS IN CONNECTION WITH THE PERITONEUM.—*Hydatid cysts** and *cancerous growths* are sometimes developed in connection with the peritoneum.

Cancerous growths of the peritoneum nearly always spread from some neighbouring organ, and very rarely appear primarily in this serous membrane.

Fatty growths and fibroid tumours are not uncommonly met with in connection with folds of the omentum and mesentery, and in other situations. Some of these tumours are pedunculated, and are thus liable to strangulate the intestine by entwining their necks around it.

These tumours cannot be diagnosed during life.

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* *Vide* Chapter on Animal Parasites.

SECTION VI.

DISEASES OF THE LIVER.

GENERAL PHYSIOLOGICAL AND PATHOLOGICAL CONSIDERATIONS.

Diseases of the liver are of far less frequent occurrence in the horse than in man, but they are nevertheless of great importance, owing to the many and varied functions performed by this organ in health.

The liver has at least three important functions.

In the first place, it is concerned in the elaboration and secretion of bile. Secondly, amyloid and saccharine substances, brought to it by the portal vessels from the alimentary canal, are converted into glycogen.

Glycogen ($C_6H_{10}O_5$), or animal starch, is a substance resembling dextrin, and is similarly convertible into sugar by the action of albuminoid ferments. It is formed and stored up in the hepatic cells, whence it is removed as required by the hepatic veins, and is thus distributed throughout the system to be used as required.

It is used partly for the maintenance of the bodily heat, which is generated during its oxidization into carbonic acid and water, and partly to take an important share in the growth, development, and functional activity of cells, and also probably in the development of the blood corpuscles.

Glycogen is in all probability convertible into fat in the system.

Thirdly, the liver is concerned in the reduction of various albuminous matters brought to it into simpler compounds.

The latter include glycogen, leucin, tyrosin, uric acid, hippuric acid, and urea.

Of the clinical features of hepatic disease, jaundice, local pain in the region of the liver, manifestation of colicky pain, persistent pain in the off-shoulder, ascites, congestion and enlargement of the spleen are among those most commonly met with.

From the point of view of the comparative pathologist it is most interesting to observe how closely these manifestations of hepatic disorder correspond with those presented by man, in whom the lameness in the right fore-limb of the horse is represented by pain in the right shoulder.

Pain, indeed, may be the primary factor in the production of this kind of lameness in the horse.

CONGESTION OF THE LIVER—INTERSTITIAL HEPATITIS.

Nature and Varieties.—Congestion or engorgement of the liver with blood, or with biliary secretion, is probably the most common of the hepatic diseases of the horse, and is of three varieties, (1) active, (2) passive, and (3) biliary.

1. *Active Congestion.*—Active congestion of the liver always accompanies the process of digestion in health, but it is apt to exceed the normal limits if the food be supplied in excess, or if it be of a too highly stimulating nature.

2. *Passive Congestion.*—Passive congestion is the form most commonly met with, and is due to obstruction of the circulation through the hepatic and portal veins. This variety of congestion is more especially associated with obstruction of the blood-flow, depending on dilatation or valvular disease of the heart, or on disease of the pulmonary organs.

3. *Biliary Congestion.*—Biliary congestion, or over-filling of the small bile-ducts with secretion, may arise from active or passive hyperæmia, or from both. It is due to obstruction in the ducts from the presence of parasites or other foreign bodies, or to inflammation of the mucous membrane. It usually gives rise to pain, and is sometimes associated

with epizoötic diseases. When influenza is accompanied by this form of congestion of the liver, it is termed *bilious* or *biliary influenza.*

Etiology.—The chief causes of the various forms of hepatic congestion are, previous pulmonary or cardiac diseases, specific fevers, dietetic errors, chills from exposure, and over-exertion of plethoric animals after a full meal.

Symptoms.—Slight jaundice, evidenced by the yellow tinge of the conjunctivæ, is usually a noticeable feature, especially in the variety described as biliary congestion.

Signs of digestive disturbance, such as loss of appetite and irregular action of the bowels, are usually manifested. Febrile symptoms are rarely present, unless the congestion be associated with some specific fever.

The extremities are cold, and pressure over the region of the liver causes pain.

The urine is generally scanty, and is more highly coloured than normally, and not unfrequently contains bile pigment.

Morbid Anatomy.—When congested, the liver is often considerably enlarged, from the great amount of blood it contains. This is especially the case in passive hyperæmia of this organ. The term nutmeg liver is applied to the peculiar variegated appearance of the surface on section which is found in cases of long-standing mechanical congestion.

This condition is characterized by a large accumulation of blood in the hepatic veins, which become dilated and thickened; by atrophy of the hepatic cells in the central portions of the lobules, and by increase of the inter-lobular connective-tissue.

The impediment to the return of blood causes the atrophy of the hepatic cells, and the formation of granules of pigment. When examined microscopically, the lobules are seen to be made up of broken-down cells and pigment granules.

On section, the liver presents a mottled appearance, the centre of the lobules being a dark red colour, whilst the peripheral parts are of a yellowish white.

The veins are found to be much dilated and filled with red cells.

Not infrequently, blood extravasations and ruptures, owing to the engorgement, are met with as the result of repeated attacks of congestion and inflammation of the liver.

When these ruptures or extravasations are very extensive and serious, they are manifested during life by collapse or sudden pain. When less extensive there may be no diagnostic symptoms, beyond perhaps a little abdominal pain, which may not attract our attention.

Treatment.—In cases where the congestion is not due to cardiac or pulmonary disease, and where the onset is sudden, bleeding the animal in proportion to his size and condition is recommended.

In congestion of the liver associated with the specific fevers, however, it is not advisable to abstract blood.

The blood-letting should be followed up by the use of moderate doses of aloes, and the subsequent administration of salines, such as sulphate of soda, or sulphate of magnesia.

When the congestion is gradually developed and is dependent on dietetic errors, or want of proper exercise, it is of first importance to restrict the amount of food, and attend to the sanitary conditions. In addition, salines, such as those above recommended, may be given in the drinking-water.

When associated with some specific fever, the treatment need not materially differ from that of the primary malady.

External applications, such as stimulating liniments or warm-water fomentations, are recommended by some authorities in the treatment of cases of congestion.

In order to prevent the recurrence of these affections of the liver, the diet should be limited and regular exercise should be enjoined.

HEPATITIS—INFLAMMATION OF THE LIVER.

Hepatitis (ἧπαρ, the liver; itis), or inflammation of the liver, may involve the capsule (Glisson's capsule), and its prolongations into the tissue of the gland, or it may affect the secreting structures of the organ.

1. Inflammation of the Capsule of the Liver.—Peri-hepatitis.—This disease is occasionally met with as a sequel or accompaniment of pleurisy, and sometimes it may follow inflammation of the peritoneum.

This disease cannot be diagnosed during life.

2. Inflammation of the Gland Tissue—Hepatitis.—Inflammation of the glandular structure is rarely met with in the horse. It may occur in a localized or in a diffused form, and its causes are in many cases similar to those of congestion.

In hot countries it assumes an epizoötic form, especially about the end of summer, and it is almost always connected with disease of the other abdominal organs (Gamgee). Hepatitis is very difficult to diagnose with certainty from acute congestion.

Localized hepatic inflammation, terminating in the formation of abscess, is rare in the horse, but secondary abscesses are frequently formed in the liver in pyæmia, and may be very numerous.

It seems probable that some cases described as hepatitis are in reality instances of active congestion of the liver.

CIRRHOSIS OF THE LIVER—CHRONIC INTERSTITIAL HEPATITIS.

Etiology.—Cirrhosis (χιρρος, yellow), though of more frequent occurrence in the horse than acute inflammations of the liver, is far more rarely met with than in man.

Very little, indeed, is actually known of its causes in animals. In man, as is well known, the chief agent in its production is abuse of alcoholic liquors, and, with the exception of syphilis, no other cause of this condition has been *with any certainty* ascertained.

Defective and insufficient food-supply are said by some to be the causes of cirrhosis in the horse; but, though this may be so, nevertheless in some undoubted cases good food has been supplied in abundance.

By others, cirrhosis is said to follow repeated attacks of inflammation and congestion of the liver.

Symptoms.—The symptoms of cirrhosis are not as yet clearly known. Among the most important are ascites, congestion and irritability of the intestinal mucous membrane, dyspepsia, impaired appetite, and loss of flesh. Sometimes indications of jaundice may be manifested, and the liver may be tender on pressure. There are rarely any febrile symptoms.

As a result of the congestion of the intestinal canal, gastric and intestinal hæmorrhage may follow, though this is a very rare occurrence.

Morbid Anatomy.—In the early stage of cirrhosis the liver is enlarged, from the gradual increase in the connective-tissue in the organ.

Cirrhosis consists in a cellular infiltration of the interlobular tissue, and in the development of a more or less highly organized fibroid structure, which is supplied with new blood-vessels from branches of the hepatic artery.

Gradually the fibroid structure contracts, and thus the liver becomes smaller, and altered in form. The hepatic cells undergo fatty degeneration, and the lobular vessels and ducts are compressed and obliterated. In consequence of this, the portal circulation is obstructed, and ascites and congestion of the abdominal viscera result.

Treatment.—In the first place, the diet should be carefully attended to. Internally, sulphate of sodium or of magnesium may be given twice daily, with vegetable tonics.

If there be ascites, diuretics may be administered in addition to salines and tonics.

In some cases it may be necessary to perform paracentesis abdominis.

FATTY LIVER.—Fatty changes in the organs of the body are due to infiltration of the tissue with fat, or to degeneration or conversion of the albuminous substance into fat.

Fatty liver is strictly an infiltration, but the term is used to include both these forms of change.

In the horse, fatty changes in the liver are traceable to overfeeding and want of sufficient exercise.

The blood becomes loaded with fatty materials, which are first deposited in the hepatic cells of the circumference of the lobules, and then gradually extend inwards.

The liver thus usually becomes enlarged, and increased in weight, and its margin becomes rounder and its surface smoother. It is of a soft or doughy consistence, and shows a pale, greasy surface on section.

In this affection there is no ascites or jaundice, but the functions of the liver are impaired if the fatty change is considerable.

The only treatment consists in regulation of the amount of exercise and limitation of the diet, and in the occasional administration of a purgative.

LARDACEOUS LIVER.—Lardaceous degeneration of the liver is sometimes met with after death, but there are no clinical symptoms by which it may be positively diagnosed during life.

The characters and appearances presented by lardaceous degeneration of the various organs of the body has already been described (page 31). When involving the liver, the conversion of the albuminous substances into lardacein usually commences in the *middle zone of the lobules*, corresponding with the distribution of the hepatic artery.

Lardaceous degeneration of the liver is often accompanied by similar changes in other abdominal organs, and is attended by general impairment of health and progressive loss of flesh.

HYDATID TUMOURS AND OTHER MORBID GROWTHS OF THE LIVER.

Hydatid Tumours.—Hydatid tumours (*ὑδατις*, a vesicle) are usually due to the development of the cysticercal embryo of the Tænia Echinococcus of dogs.

They are not of common occurrence in the horse, though the liver is perhaps more frequently their seat than any other organ.

The relationship between a cysticercus and its fully developed mature tapeworm is described in the Chapter on Animal Parasites, to which the reader is referred for the full history.

A hydatid tumour consists of a primary sac or bladder, with thick, soft, transparent, and laminated walls, the innermost layer of which is formed by a delicate cellular membrane. The sac (mother-cyst) is filled with clear, limpid fluid, in which are numerous daughter-cysts. On the inner surface of these secondary cysts there are situated many little prominences, which consist of small vesicular bodies, each surmounted by a head. These are the immature forms of the Tænia Echinococcus.

The tumours do not present any symptoms by which their presence can be diagnosed.

Cancerous Tumours.—When infiltrated with nodular or diffuse so-called cancerous tumours, the liver is enlarged, and may be altered in shape.

Some of these morbid growths spread rapidly, while others extend much more slowly.

The growths are of rare occurrence in the horse.

Melanotic Deposits.—Melanotic growths are occasionally found in the liver in circumscribed patches, or in diffused masses.

Lymphoid Tumours.—Lymphoid growths, when occurring in the liver, are often numerous. They occur as smooth nodules of varying size.

JAUNDICE—ICTERUS.

Jaundice is, strictly speaking, a symptom of many affections in which the tissues of the body are dyed yellow; but it is of such importance as to merit a separate description. Jaundice (*jaunir*, to become yellow), or icterus (ἰχτεϱος, a yellow bird), is so called from the yellow discolouration of the conjunctivæ, skin, and visible mucous membranes, due to impregnation with the biliary pigment.

Etiology.—Jaundice may be due to—

(*a*) *Excess of bile in the blood.*—This may be caused by obstruction to the flow of bile into the duodenum, leading to absorption of the secretion by the blood, which thus becomes contaminated.

Obstruction may depend on catarrhal inflammation of the mucous membrane of the ducts, or upon the presence of foreign bodies in the bile-duct.

Excess of bile in the blood may also depend upon excessive secretion, which also leads to absorption.

This occurs in hepatic congestion.

(*b*) *Suppression of the secretion of bile, or interference with its metamorphosis.*—This may occur in certain specific fevers and general disorders ; for example, influenza and pyæmia.

Symptoms.—The symptoms of jaundice are rarely well marked in the horse. As a result of impregnation with bile pigment, the tissues soon become stained yellowish ; the conjunctivæ, skin, and the visible mucous membranes more especially show the yellow staining.

The urine becomes more deeply coloured from the presence of bile pigment, and the motions become drier and of lighter colour, from the deficiency of bile flowing into the duodenum.

Unless jaundice follows a general or specific disease, there are usually no febrile manifestations, and the pulse is in most instances not accelerated, and the temperature similarly remains normal.

In some cases loss of appetite and digestive disturbance are marked features, and depression, languor, and incapacity for exertion follow.

Itching and cutaneous eruptions on the skin are occasionally met with in severe cases.

Lameness in the off-shoulder is in some instances an accompaniment of jaundice.

Tests for Bile Pigment and Bile Acids :—

Gmelin's test for bile pigment in the urine.—Add a drop or two of strong nitric acid to a small quantity of urine on a piece of white porcelain, when, if there is bile pigment present, there will be a play of colours, passing through green, blue, violet, and red, into a dirty yellow.

Pettenkofer's test for bile acids in the urine.—Add to a small quantity of the urine, in a test tube, a very small quantity of cane sugar, and afterwards pour in some strong sulphuric acid very slowly. If bile acids be present, there will be first thrown down a white precipitate of cholalic acid, and afterwards the whole of the liquid will become of a deep, beautiful purple colour. This reaction is facilitated by gently warming the side of the test tube.

Treatment.—When jaundice is developed in connection with a specific fever, no special treatment is required, unless the symptoms be of a very pronounced character.

In other cases the treatment depends upon the cause of the affection.

In the first place it is necessary to increase the amount of exercise, if this be insufficient, and to restrict the amount of food allowed.

Mild cases may require no further treatment beyond the occasional administration of saline purgatives, or moderate doses of aloes.

When depending on hepatic congestion, the treatment is similar to that already described under this affection.

If jaundice be attended with much debility and languor, vegetable tonics, with doses of nitro-hydrochloric acid, may be given three times daily.

Besides the remedies already mentioned, chloride of ammonium and calomel, in moderate doses, are also recommended in some forms of jaundice.

SECTION VII.

DISEASES OF THE SPLEEN.

General Physiological Considerations.—Very little is known of the functions of the spleen. In this organ white blood corpuscles appear to be formed, and red corpuscles to be broken down. The spleen receives an abundant supply of blood, and undergoes considerable changes in volume. It has movements of contraction and expansion, which are slow and rhythmical. The spleen may be exterminated in animals and man without any serious ill effect. Hypertrophy of some of the lymphatic glands, and red marrow of bones follows, and these tissues probably take on a vicarious function. The blood coming from the spleen is said to contain a larger number of white cells than that entering it.

In diseases in which the spleen is enlarged, the blood contains a large excess of white cells.

Diseases of the spleen are very rarely, if ever, diagnosed in the horse during life, though various pathological changes are not uncommonly met with in making post-mortem examinations.

Enlargement of the Spleen.—Enlargement of the spleen is of rare occurrence, except when depending on abnormal growths, as lymphadenoma and melanosis.

Lymphadenoma.—Lymphadenoma of the spleen is sometimes found as greyish masses of about the size of a cherry, and sometimes still larger.

These formations in the spleen are said by some to be accompanied by leucocythæmia (λευκος, white; κυτος, a cell; and ἀιμα, blood) in many cases.

There are no diagnostic symptoms by which these tumours can be recognised during life.

They are, however, not unfrequently accompanied by anæmia, anorexia, and loss of flesh.

When examined microscopically, we have found these tumours of the spleen to be composed of an *adenoid reticulum*, or network of fine homogeneous fibrils, the meshes of which are completely occupied by lymph corpuscles.

Other Morbid Growths of the Spleen.—Cancer, melanotic growths, and lardaceous degeneration are sometimes met with after death, but cannot be diagnosed during life.

CHAPTER VIII.

DISEASES OF THE URINARY SYSTEM.

THE URINE IN HEALTH AND IN DISEASE.

As renal diseases are intimately connected with alterations in the character of the urinary secretion, a knowledge of the chemical composition of the urine, and of the alterations it may undergo in disease, is of great importance.

THE URINE IN HEALTH.—Healthy urine is an amber-coloured fluid, varying in composition in different animals, but containing in all analogous products of nitrogenous waste and various salts.

In the carnivorous animal it is a clear watery fluid of acid reaction. In herbivorous animals it is either alkaline when secreted, or very soon becomes so; and is often cloudy, depositing a sediment on standing.

These differences in the character of the urine depend upon the nature of the food of the animal.

If a herbivore be fed solely upon a nitrogenous diet, the urine becomes acid, as also it does in certain diseases. In inanition, also, where the body may be said to feed upon its own tissues, the urine of herbivora likewise becomes acid. Similarly, if a carnivorous animal be fed upon vegetables, the urine becomes alkaline and cloudy.

The urine of the mammalia contains a large amount of water, and in the horse has a specific gravity of 1030—1050.

According to our own investigations the average of a large number of estimates of the specific gravity of the urine is 1041·2.

The actual amount of urine passed per day is estimated by Colin at 15—25 litres (44·033—61·646 pints); this estimate gives an average 20 litres a day. This amount is somewhat in excess of the average—18·91 litres—found by us in a number of cases.

The quantity of water in 1,000 parts of urine has been estimated at 880—930 (Von Bibra and others).

The chief constituents of the urine are water, products of nitrogenous decomposition, of which urea is the most important, hippuric and uric acids, inorganic salts, extractives and colouring matters.

The actual amount of solids in 100 parts of urine of the horse we have estimated to average 8·955.

Urea.—Urea is by far the most important of the solid constituents of the urine. It is derived from the disintegration or metamorphosis of albuminous and albuminoid substances of the food and of the tissues, and contains most of the nitrogen which was originally incorporated with the substances from which it is derived.

Urea, or carbamide ($CO(NH_2)_2$) is isomeric with ammonium cyanate (NH_4CNO, or CH_4N_2O). It is excessively soluble in water, from which it crystallizes in white silky needles or transparent four-sided prisms, the ends of which are often formed by one or two inclined planes.

It has a bitter saline taste, is colourless, soluble in alcohol, but insoluble in ether.

Nitrate of urea may be obtained in considerable quantities by the addition of excess of nitric acid to concentrated urine.

This salt crystallizes in rhombic prisms or plates, having a characteristic imbricated arrangement and mother-of-pearl lustre.

Oxalic acid similarly throws down oxalate of urea, which crystallizes in rhombic plates or prisms.

In the urine of the horse the urea bears a proportion of about 1 to 8, or 1 to 9, of all the solids (Gamgee).

The amount of urea secreted bears a definite relation to the amount of food taken into the system. It is largest when the food is albuminous and abundant; it is rapidly diminished by starvation, and gradually by a diet containing a large proportion of amylaceous or starchy matter.

It is augmented by increased amount of water drunk, and by the ingestion of sodium chloride and ammonium salts.

Urea is probably to a great extent formed in the liver, and its amount is most likely largely influenced by the condition of the hepatic cells and by the activity of the hepatic circulation.

Urea is also increased in many febrile disorders. In acute pneumonia and in laminitis we have especially noted a very large increase in the amount passed, and have already spoken of the amount in azoturia. (*Vide* 'Azoturia.')

Retention of urea in the blood in interference with the secretion of urine is associated for the most part with organic renal disease, though it may also be due to obstruction in the ureters. Urea, when thus retained in the blood, gives rise to an aggregate of symptoms termed **Uræmia.**

Uric Acid.—The urinary secretion of herbivorous animals contains little or no uric acid ($C_5H_4N_4O_3$), as this substance is represented in them by hippuric acid. It occurs, however, in the urine of man, and in that of almost all carnivorous animals. Uric acid can be crystallized from urine containing it by adding hydrochloric acid, which by decomposing the urates sets the uric acid free.

The most common forms of uric acid crystals are the whetstone-shaped, and the sheaf-like bundles of flattened needles.

Uric acid is insoluble in alcohol and ether, and very feebly soluble in water.

Hippuric Acid.—Hippuric acid ($C_9H_9NO_3$) occurs in very small proportion in the urine of man (less than ·1 per cent.) and carnivora, but is present in abundance as alkaline hippurates in that of herbivorous animals. Hippuric acid is a beautiful white crystalline substance, soluble in 400 parts of cold water. It is also soluble in ether and alcohol.

When the quantity of urea in the urine is small, that of hippuric acid is large, and vice versâ. It varies from five to fifteen parts in 1,000 of the urine of the horse (Bibra).

Hippuric acid crystallizes in long, transparent, four-sided prisms, and may be readily obtained by boiling the urine of an herbivore and adding hydrochloric acid.

It is noteworthy that in all animals in which the urine contains much hippuric acid, as in the horse, indigo is also present in relatively large quantities (Sanderson).

Hippuric acid is said to be formed in the system from the benzoic acid, or bodies which yield benzoic acid, which is ingested.

This acid is also said to appear in the urine of man and herbivora whenever benzoic acid ($C_7H_6O_2$) enters the system, glycin (glycocoll) being taken up and water given off.

Extractives.—The extractives found in the urine of the horse are creatin, creatinin, lactic acid, benzoic acid, and several others.

Pigmentary Matter. — The pigmentary or colouring matters of the urine of the horse are not of much physiological importance.

Inorganic Salts. — The urine of carnivora contains sulphates, chlorides, and phosphates ; that of herbivora contains a large percentage of carbonates, with some sulphates and chlorides. The urine of the latter, therefore, is found to effervesce on the addition of an acid. The chief metallic elements found in the urine are sodium, magnesium, calcium, and potassium.

Von Bibra found in 1,000 parts of the urine of the horse 42·20 parts of salts, which were composed of 78·37 per cent. of carbonates of lime, magnesium, potassium, and sodium; 13·04 per cent. of sulphate of potassium; 6·94 of chloride of sodium, and ·055 of silica.

The deposit which settled on allowing the urine to rest, being analyzed three times by Von Bibra, was found by him to have the following composition:

	I.	II.	III.
Carbonate of Calcium	80·9	87·2	87·5
Carbonate of Magnesium ...	12·1	7·5	8·5
Organic Material	7	5·3	4·3

THE URINE IN DISEASE.—In some diseases one or more of the normal constituents of the urine are increased, while in other affections they may be diminished in amount. Moreover, various abnormal constituents may be found in the urine in disease which are not present in health.

INCREASE OR DIMINUTION OF THE NORMAL CONSTITUENTS.—The amount of urine passed varies considerably, even in health. Some diseases, however, are especially characterized by an increase, while in others the secretion is much diminished. The urine is always scanty in febrile conditions and in acute inflammation of the kidneys, and may be almost or quite suppressed, as in collapse.

In diabetes insipidus, or hydruria, and in certain other conditions, as when diuretics are taken, the urine is increased, owing to the excess of water eliminated through the kidneys.

The amount of urine may be much increased without any augmentation in the amount of solid constituents.

The specific gravity of the urine, however, is, as a rule, in inverse proportion to the amount passed; but under some conditions, as in diabetes mellitus, the density is high, although the urine is abundant. Again, we cannot conclude that there is an excess of solids present when the specific gravity is high, for this may be due to deficiency of water.

The re-action of the urine is normally alkaline, though in certain diseases it sometimes becomes acid. The reaction may be tested by litmus paper. If alkaline, urine turns red litmus blue; if acid, it turns blue litmus red.

We have already said that the amount of urea excreted may be increased or diminished under various abnormal conditions.

ABNORMAL CONSTITUENTS PRESENT IN THE URINE IN DISEASE.—Blood.—Blood is sometimes present in the urinary secretion, and may be derived from the kidneys, ureter, bladder, or from the urethra.

The passing of blood in the urine is termed **hæmaturia.**

When the blood has its source in the kidneys, it gives a general red or brownish smoky hue to the urine; which, on standing, deposits a brownish red sediment, in which blood-casts are often present.

In hæmorrhage from the bladder, the blood is far less intimately mixed with the urine, and often appears only toward the end of micturition, while the urine is of a pinkish or blood-red colour, and is associated with the symptoms of vesical disease.

Where blood is derived from the urethra, it is voided independently of micturition.

The causes of renal hæmorrhage may be arranged in two classes:

1. Local pathological lesions, viz.,

(*a*) Those due to congestion or inflammation of the kidneys.

(*b*) Cancerous or melanotic growths, or the presence of calculi in the kidney.

2. Symptomatic causes, or those depending upon some general or constitutional disease.

Blood-casts, or moulds of the uriniferous tubes formed by the coagulation of the blood in their lumina, are not uncommonly found in the urine in cases of renal hæmorrhage.

Blood in the urine may be detected by the presence of the red corpuscles seen in it when examined microscopically.

The appearance of the cells varies somewhat according to the specific gravity of the urine; if it be high, the cells are small and shrivelled; if it be low, they are large, transparent, and circular.

The urine may also be tested by the addition of a drop or two of tincture of guaiacum and a few drops of ozonized ether to a small portion in a test-tube, when, if blood-pigment be present, the ether which collects at the top will be coloured blue.

Urine containing blood is of necessity albuminous.

Albumen.—The presence of albumen in the urine in any quantity is of pathological significance. It may be found in the urine from structural changes in the kidney in renal congestion, or may be due to the presence of blood or pus.

Albumen, when present, may readily be detected.

If the urine be alkaline, as it frequently is, it is first necessary in testing it to add a few drops of acetic acid to a small portion in a test-tube, in order to slightly acidify it. After this the urine should be boiled, when, if albumen be present, it will be coagulated, forming opaque flakes, which gradually subside to the bottom of the tube.

Albumen may also be tested for by nitric acid. This test consists in pouring into a test-tube a small quantity of strong nitric acid, and then pouring very slowly down the side of the tube a little of the urine to be examined. If albumen be present an opaque white cloud forms immediately where the two fluids come into contact.

A saturated solution of picric acid also precipitates albumen, and picric acid tablets are now sold by chemists, and afford a ready method by which the presence of albumen may be detected.

Bile Acids and Bile Pigment.—Under the diseases of the liver, we have already spoken of the occasional presence of bile acid and pigment in the urine, and have given tests by which their presence may be recognised.

Grape Sugar.—Grape sugar is found in the urine in diabetes mellitus, under which disease tests by which this substance may be detected have been mentioned.

The fermentation test may also be applied. If a little yeast be added to urine containing sugar, after standing for some time in a warm place, it will ferment, with the disengagement of carbonic acid.

Pus and Mucus.—Pus is sometimes found in the urine, which is albuminous in proportion to the amount of pus present. If examined microscopically, the sediment is seen to contain pus-cells which are very similar to white blood-cells. They are, however, lifeless, and have no amœboid movements, and are characterized by the presence of several nuclei.

SECTION I.

DISEASES OF THE KIDNEYS.

RENAL CONGESTION. — **Etiology and Symptoms.**—Hyperæmia, or congestion of the kidneys, may be active or mechanical. It is not often met with in the horse.

Active congestion constitutes the first stage of inflammation of the kidneys, or nephritis. It sometimes occurs as the result of acute fevers, and may be induced by the ingestion of certain irritants, as turpentine and cantharides, or by the action of cold and damp.

Passive or mechanical congestion depends upon venous obstruction from pulmonary or cardiac disease.

When examined, the kidneys are seen to be enlarged and engorged with blood.

If the congestion, especially when mechanical, be of long duration, important structural changes of a chronic inflammatory nature may follow.

Renal congestion is usually attended with a scanty secretion, and if very severe, there may be a quantity of albumen, blood, and a few renal casts, but otherwise there are few or no general symptoms by which this affection may be diagnosed.

Treatment.—When dependent upon other affections, renal congestion must not be treated apart from the general disease.

In other cases, rest, laxatives, and the application of warm fomentations to the loins are all that is required.

INFLAMMATION OF THE KIDNEYS.—NEPHRITIS.—Inflammation of the kidneys, or nephritis (*νὲφρον*, the kidney), is of rare occurrence in the horse.

In *acute* nephritis, as in all acute inflammations, the *cellular* structure of the organ is chiefly involved, whereas when this passes on to the *chronic* form the changes are more especially marked in the *interstitial* tissues.

Inflammation of the pelvis of the kidney, or pyelitis (*πυελον*, pelvis), except when resulting from the irritation of a calculus, is of rare occurrence in the horse. Professor Williams mentions a case of pyelitis in a foal two days old, which died of acute suppurative arthritis.

Symptoms of Nephritis.—When nephritis supervenes on some acute fever, the urine may be noticed to become more scanty and highly coloured, and may contain albumen and renal epithelial casts. Blood, and fibrinous or sanguineous casts may also be present.

The internal temperature is raised still higher, and the skin becomes harsh and dry.

There is usually little or no pain on pressure of the loins in this form.

In nephritis due to other causes, the symptoms are somewhat different. There is considerable fever with colicky pains, the attack resembling colic, attended by fever. The pulse is quickened, and the artery is full, hard, and firm. The respirations are short and accelerated, the bowels are constipated, and thirst is increased. In some instances there is stiffness, tenderness in the loins, and arching of the back, but these symptoms are not invariably present.

The most characteristic features of nephritis are the scanty elimination or total suppression of urine and the desire to micturate frequently. The animal strains violently, but may be unable to pass more than a few drops of urine. This is highly-coloured, and if examined, albumen, blood, and renal casts may generally be detected in it.

Where, however, no urine is passed, the continued fever, abdominal pain, and frequent, though ineffectual, straining to micturate, are indicative of inflammation of the kidneys. But cases of nephritis are met with sometimes, in which the only symptoms are suppression of the urine (ischuria), with febrile manifestations, and of this several instances have come under our notice.

In other cases there are signs of pain manifested by lying down and rolling about, while at other times the seat of pain is pointed at by the animal turning round and endeavouring to bite at or scratch the loins.

If suppression of the urine be prolonged; other symptoms supervene, owing to retention of urea in the blood. The accumulation of urea, as we have already indicated, gives rise to symptoms of uræmic poisoning. The animal becomes partially unconscious, but there is no loss of motor power.

Retention of the urine may, however, continue for several days without the manifestation of coma.

As the urea gradually accumulates in the blood, there is a peculiar ammoniacal odour of the breath, which is also emitted from the skin and fæces.

The bowels are usually constipated, and muscular twitchings are not uncommon.

In the stallion, there may be retraction of the testicle on the affected side.

Sequelæ.—Chronic nephritis may be left as a sequel after the subsidence of an attack of acute inflammation of the kidneys, or it may manifest itself as an independent affection.

Atrophy and degeneration of the kidneys may follow acute nephritis.

Morbid Anatomy.—In acute nephritis, one or both kidneys are involved. They are much enlarged and engorged with blood. The surface is smooth, and the capsule is thin and non-adherent.

On section the colour is of a dark dusky red, and the malpighian bodies are of a still darker hue. At a later stage the cortical part of the kidney becomes paler or mottled, and contrasts strongly with the dark-red bases of the pyramids.

If a section be examined microscopically, the uriniferous tubules are found to be filled with epithelial cells in various degrees of disintegration, fibrinous material, and blood. These changes are more especially marked in the convoluted tubes.

The blood-vessels are distended with blood. In chronic nephritis supervening on the acute variety, the appearances may differ but little from the above, except in the great paleness of the cortex. In all long-standing cases the interstitial-tissue becomes more involved in the pathological change. It first becomes increased in amount, and afterwards contracting, leads to contraction and atrophy of the kidney.

In acute pyelitis there is redness, swelling, and ecchymosis of the lining mucous membrane, and a discharge of mucus and pus.

In chronic pyelitis the mucous lining is thickened, and the pelvis is dilated and may be filled with pus, which is due to the irritation caused by one or more calculi. Abscesses are sometimes found in the cortex of the kidney as the result of pyelitis. They may also be formed as the result of chronic inflammation of the kidney itself, or from an injury.

Treatment.—In acute nephritis caused by cold, fatigue, or exhaustion, if the pulse be strong, bleeding is very beneficial. Those cases, however, supervening upon various fevers, or due to injury, do not bear depletion so well. In this connection we may observe that the knowledge of the use of aconite is of extreme value in the practice of the medical art. We have had great and marked success in the treatment of animals affected with nephritis, when it has been decided not to bleed them, by the judicious administration of tincture of aconite.

The bowels should be freely acted upon by the administration of some purgative. Aloes is perhaps the best cathartic in the horse. Oil is not so reliable. The looseness of the bowels should be kept up by the administration of saline purgatives, such as sulphate of sodium, or sulphate of magnesium, which may be given in the water.

Some authors recommend the administration of opium, if the pain be great, but this remedy is best withheld in the treatment of nephritis.

The pain may be relieved by the application of woollen cloths wrung from hot water, or of linseed-meal poultices over the loins.

The poultices and fomentations may be medicated by the addition of belladonna or digitalis, with great advantage.

The diet should be laxative, consisting of linseed and oatmeal gruel, and bran mashes.

When the acute symptoms have abated, salts of iron and vegetable tonics are indicated.

LARDACEOUS DEGENERATION OF THE KIDNEY.—Lardaceous degeneration is very rare in the kidneys of the horse.

On pathological grounds it should be distinguished from chronic nephritis. The appearance of the kidney resembles that of other organs similarly affected.

MELANOTIC TUMOURS AND HYDATIDS.—Melanotic tumours are sometimes, though rarely, found in the kidney of the horse.

Hydatids of the echinococcus have been met with in the kidney, though they are of far commoner occurrence in the liver.*

RENAL AND URETERAL CALCULI.—Renal calculi are rather rare in the horse, though they are met with in this animal more frequently than in any other. Ureteral calculi are of such rare occurrence as to require no special description here.

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* About a month or two ago we had under treatment an aged cart-horse suffering from chronic renal disease. The horse had great difficulty in passing water, and this contained abundance of pus and mucus. After death the post-mortem examination revealed about thirty hydatid cysts in the right kidney. They varied considerably in size, one being as large as a cocoanut; the others varied from the size of a walnut to that of a pea. In the left kidney there were also more than a dozen of these cysts, which were for the most part of less size. There were none present in the liver, though a great number were found in the substance of the psoas muscle. The right kidney was considerably atrophied.

Renal calculi are of a brownish-white, sometimes bluish colour, of irregular ovoid or nearly spherical shape, often nodulated, and always more or less rough, owing to the irregular deposition of carbonate of lime. They are placed in cysts with firm parietes, which contain a quantity of thick urine. They are distinctly laminated, and often numerous (Gamgee).

The deposition of calculi in the kidneys does not often cause symptoms by which their presence can be diagnosed. The urine, however, is often charged with earthy matter, and there may be occasional internal hæmorrhage and colicky pains, especially after the animal has been severely worked or exhausted.

Analysis of Renal Calculi of the Horse (Furstenberg).

	1.	2.	3.	4. *Corral Form.*	5. *Round Form.*		6. *Round Form.*	7. *Laminated Form.*	8. *Sedimentary Form.*
Specific gravity ..	2·263	2·241	2·121	2.283	2·194		2·193	1·918	1·6
					Centre of Stone.	*Surface.*			
Carbonate of lime	·84·20	69·4	85·90	41·30	78·46	73·24	38·45	40·57	89·40
Carbonate of magnesia	1·56	9·1	5·20	11·04	4·66	5·37	38·29	16·28	3·35
Oxalate of lime ..	5·31	6·5	Trace	28·46	15·11	17·22	14·49	..	..
Phosphate of lime	..	..	..	7·03	..	..	..	..	..
Chloride of calcium	..	Trace	..	..	..	..	..	..	..
Sulphate of lime ..	..	Trace	..	..	..	..	..	..	..
Organic material ..	6·05	5·5	7·70	10·37	0·56	2·92	7·65	40·72	4·35
Water, Iron and loss	2·88	9·5	1·20	1·80	1·21	1·25	1·12	2·43	2·90
Total	100·00	100·0	100 00	100·00	100·00	100 00	100·00	100 00	100 00

Treatment of Renal Calculi.—Renal calculi are best treated by the administration of hydrochloric acid.

The diet should be well regulated.

In some instances calculi become impacted in the ureter, inducing more or less rapid degeneration of the kidney and suppuration in its substance. Their impaction and passage along the ureters cause relapsing, excruciating pain.

SECTION II.

DISEASES OF THE BLADDER.

CYSTITIS, OR INFLAMMATION OF THE BLADDER.

Etiology.—Cystitis is rarely met with in the horse.

It may be caused by the administration of certain irritants, as cantharides or turpentine, or by the absorption of cantharidine from a blister. It may also be set up by the presence of calculi or morbid growths.

Symptoms.—The animal becomes restless, and shows signs of pain; he makes frequent attempts to pass water, but micturition is attended with difficulty and pain.

There are also signs of constitutional fever. If the cystitis be due to cantharides, or croton oil administered by the mouth, the alimentary canal throughout is more or less inflamed. If cantharides be absorbed from a blistered surface, the effect is chiefly upon the urinary organs, causing hæmaturia and sexual excitement.

Morbid Anatomy.—The mucous membrane of the bladder is variously altered in proportion to the intensity of the inflammation.

The lining membrane usually presents an appearance of ordinary acute or chronic catarrhal inflammation, attended with more or less secretion of mucus or muco-pus. The urine often becomes rapidly ammoniacal. In very severe cases the mucous membrane may become ulcerated.

Treatment.—In cystitis arising from absorption of irritant poison from a blister, the latter should be at once washed off.

Internally, opium and hyoscyamus, or belladonna, are indicated. The bowels should be regulated by laxative diet, and demulcent drinks should be allowed.

If there be much pain, and marked constitutional disturbance, moderate blood-letting, followed by mild purgatives, is to be recommended. Hot fomentations applied to the abdomen are very beneficial also in alleviating the pain when severe.

In chronic cases, hyoscyamus, buchu, and copaiba, with saline purgatives, are recommended by some. By others, mineral acids, with iron, are said to be very beneficial in the treatment.

RETENTION OF URINE.

Etiology.—Retention of urine is caused by spasm of the neck of the bladder in colic. It is a common complication in paraplegia, in enlargement of the prostate in aged animals, in urinary or urethral calculi, and in cancer of the penis. It may also be caused by obstruction at the opening of the urethra, prolapse of the uterus or vagina, or by accumulation of fæces in the rectum, or of dirt in the sheath (Williams).

Inability to urinate may be due to other causes, as, for example, when an animal cannot rise in azoturia, laminitis, or paralysis.

Paralysis of the bladder, due to over-distension of the walls by urine, may be the cause of retention. This sometimes occurs when an animal is not able to micturate for a lengthened period during a long journey.

Symptoms.—The animal, although making frequent attempts to micturate, is unable to pass water.

Sometimes a few drops may be passed; at other times, none at all.

In some cases there is a continual dribbling of the urine. In retention, if the bladder be examined by the hand passed through the rectum, it will be found distended.

Treatment.—The treatment of retention is essentially surgical. Careful catheterization is necessary in most cases, though in some instances pressure on the distended bladder by the hand passed through the rectum will suffice.

INCONTINENCE OF URINE.

By incontinence we mean an inability to retain the urine.

In some instances retention is accompanied by incontinence of urine, which continually dribbles, owing to the great distension of the bladder. In other cases incontinence may be due to the presence of calculi, or to paralysis of the sphincter vesicæ.

When due to over-distension, the incontinence must be treated by catheterization.

When due to paralysis, nux vomica and vegetable tonics with injection of cold water into the rectum are indicated.

CHAPTER IX.

DISEASES OF THE REPRODUCTORY SYSTEM.

HYSTERIA.

During the period of œstrum in the mare, symptoms resembling those of hysteria have been observed.

In two cases described by Professor Williams, the symptoms manifested were—clenching the jaws, grinding the teeth, difficulty in deglutition, and squinting, together with some degree of trismus, and tonic alternating with clonic spasms of the voluntary muscles.

Kicking with the hind-legs in a most persistent and uncontrollable manner, stamping with the hind-legs, and other indications of great restlessness and excitement, are very marked in some cases. The vulva, when examined, is found to be in a hyperæsthetic condition, being opened and closed in rapid succession. The urine, which at first is excessive, becomes more scanty and high-coloured.

In one of the cases recorded, the animal was prostrate and rigid, and appeared as though in a state of trance.

In the case of a mare recently under our notice, the animal kicked violently and almost continuously, and there was great sexual excitement. The urine was pale, watery, and abundant. The mucous membrane of the vulva and vagina was highly congested.

Treatment.—Depletion was practised in the former two cases, one of which recovered. The bleeding was followed by the administration of cathartics. In the case before our notice, a moderate dose of aloes was first given, and was followed up by the administration of full doses of potassium and sodium bromide, with tincture of asafœtida three times daily. A laxative diet of bran-mashes and linseed-gruel was ordered. The mare recovered completely in a few days.

PARTURIENT FEVER.

Definition.—Parturient fever is a febrile condition occurring usually in from twenty-four hours to three days after parturition, and usually terminating in recovery.

Etiology.—The fever affects animals of all ages, but is of more frequent occurrence after the first parturition or abortion; but the malady may come on after later deliveries or acts of parturition.

It may possibly be in some degree caused by cold, or by mal-hygienic conditions; and it may also be induced by dietetic errors.

Symptoms.—The pulse is quick and full, and the respirations are accelerated. The bowels are constipated, and the temperature is raised somewhat.

The visible mucous membranes are injected; the secretion of milk is arrested, and the lacteal gland is harder and hotter than normally.

Treatment.—A mild oleaginous purgative should be given, and should be followed up by the administration of liquor ammoniæ acetatis and nitric ether.

The diet should be laxative, and restricted in amount.

This disease appears to be purely a form of septicæmia. Mr. J. B. Gresswell was once called to a case of parturient fever occurring in a five-year-old cart-mare. The temperature was at first 104·5° F; the pulse was 78; the respirations were considerably quickened, and in number between 20 and 30. There was almost total loss of appetite, the mare only taking linseed gruel, and the bowels were constipated. The visible mucous membranes were injected. The mare progressed very favourably. A purgative was given, and should be given in all cases. Salicylic acid in two-drachm doses was administered thrice daily. The temperature gradually went down to the normal point in about four days' time, from which time the animal made a gradual recovery. The mare assumed the recumbent posture at intervals during the progress of the malady. In some cases there may be a complication by reason of the mammary glands swelling, and swelling of neighbouring structures under the abdomen.

Many cases are of a mild character, the temperature often not rising above 102° or 103°, the pulse being about 60 or more, the bowels costive, and the respirations slightly accelerated. Slight uneasiness, and other indications of abdominal pain, may be exhibited.

ACUTE METRITIS.

Acute metritis, or acute inflammation of the uterus, occurs within a few hours to three or four days after parturition, and is an extremely fatal disease.

Etiology and Nature.—The causes of acute metritis are fatigue previous to parturition, injuries to the uterus and vagina during delivery, and retained placental membranes. This disease may also be induced by exposure to cold or other debilitating influences.

Acute metritis may be regarded as due to pyæmia, or septicæmic poisoning, depending generally on absorption of septic matter from the parturient canal. Secondary foci of inflammation appear in the brain, lungs, and other organs.

When due to the retention of the placental membranes, the disease depends upon the decomposition of coagula and pieces of the placenta within the uterus, and the absorption of the products of their disintegration into the blood.

Symptoms.—The animal is uneasy, and loses its appetite. The milk becomes very nearly, or quite suppressed.

If any can be squeezed out, it is of a bluish tint, and thin and watery, or it may be a reddish-brown colour.

The vulva is small and contracted, and the vaginal mucous membrane sometimes of a deep red or purple hue, with petechial spots and purple streaks.

There is violent straining, and the discharge of a dark-coloured, fœtid, decomposing fluid.

The pulse is feeble, thready, and accelerated; the heart's action disturbed; the surface of the body cold.

The animal shows signs of abdominal pain, and sometimes manifests symptoms of inflammation of the feet.

As the disease progresses the animal gradually falls, the pulse becomes feebler and feebler, and the breathing hurried and thoracic, until at length complete unconsciousness sets in, the animal dying in from twelve hours to two days or more after the onset.

Morbid Anatomy.—There is diffuse inflammation of the mucous membrane of the uterus, which soon extends to the uterine veins.

The inflammation extends to the peritoneum and intestines, and tends to spread over a large surface.

The inflammatory exudation is dark coloured and abundant.

That which is effused into the uterine cavity causes great irritation and straining, and is discharged through the vagina.

Examined microscopically, the discharge is found to consist of blood globules, pus, and much granular matter intermixed with shreds of lymph.

Treatment.—In the first place it is essential that the uterus and vagina be washed out by injections of Condy's fluid, carbolic acid, or hypo-sulphite of sodium, very largely diluted with warm water.

This is necessary in order to prevent the further absorption of septic matter.

The strength of the animal should be supported by the internal administration of alcoholic and other stimulants.

If the temperature be very high, salicylate of sodium or quinine should be given in addition.

The abdominal pain may be relieved by opium, and hot fomentations to the loins and abdominal walls.

INFLAMMATION OF THE OVARIES, OVARITIS, OOPHORITIS.

Inflammation of the ovaries is very rarely met with in the equine species, and consequently very little is known of this disease.

Acute ovaritis, according to Percivall, appears to give rise pretty much to the same symptoms as denote peritonitis and metritis.

Chronic ovaritis is not marked by any appreciable symptoms, but lays the foundation for tumours of considerable size, which may exist without disturbance of function.

Acute ovaritis may terminate in suppuration, or pass into the chronic stage, but generally ends in resolution.

Sometimes the ovarian tumours may burst into the abdomen, and thus cause death.

MAMMITIS.

Inflammation of the udder is not of very infrequent occurrence in the mare. It seems to be more commonly met with in thoroughbred mares than in cart-mares, although it is seen in both. The disease may commence either before or after parturition.

(1) During the early part of the year 1888 Mr. J. B. Gresswell was called to attend a thoroughbred mare called Rufford Maid, the property of a well-known breeder of the Louth district. The first symptoms were seen a few days before parturition. On examination, the pulse was found to be 82, the temperature to be 104° F., and the breathing was accelerated. The mammary gland was found to be hard and swollen, and hot and painful when touched. The swelling was considerable, and it continued to increase for about nine days, until the whole under-surface of the abdomen was enormously swollen and the inguinal lymphatic glands were considerably affected.

The pulse and the temperature gradually became higher, and the breathing was very difficult indeed at the last. The pulse became weaker and faster, and the mare was kept alive with port-wine and eggs, and other nutritious food. On the last day before she died the mare seemed a little better, and began to manifest labour-pains, and it was decided to withdraw the foal. This operation, after a great deal of difficulty, was successfully performed, although the presentation was an unnatural one, the head and legs being both directed backwards. Mr. D. B. Miller, M.R.C.V.S., was present, and gave much assistance in the extraction. The foal was withdrawn alive, and lived for some few days, but, unfortunately, at last succumbed, owing partly perhaps to the cold and the lack of maternal care.

On the day after delivery the mare died, in consequence of great prostration and weakness. For a time she was kept alive with gruels and so forth, but the swelling was so enormous as to lead to death. The mare was attended day and night. The udder was fomented, but all the care and medical treatment did not suffice to save her life.

(2) A cart-mare was seized with mammitis. The pulse was quick; the temperature was 104°; the udder was hot, painful, and very much swollen. Within about seven days the mare completely recovered. The swollen udder was fomented, and external dressings were applied. Fever medicines were given internally. This was a mild and satisfactory case, and we have had others similarly saved.

CANCER OF THE VAGINA (EPITHELIOMA).

A cancer began in a mare as a small ulcerous wound situated just outside, and on the floor of, the vagina. Iodoform ointment was applied. Six weeks afterwards we saw the mare again, and it was then found that the ulcer was of the size of the palm of a man's hand. The walls of the ulcer were thickened and indurated, and the discharge which came away was fetid, and so strong that it actually led to an excoriation of all the parts which it ran over and came into contact with. About two months afterwards the mare was seen again, the owner, Mr. Riggall, of Red Lees, near Louth, not thinking it worth while to doctor the animal systematically. On this third occasion the ulcer was found to be wider, deeper, and covering a much larger area. It extended at least four or five inches into the vagina, and about six inches below, and now involved the meatus urinarius, so that the discharge of urine was extremely painful.

One would hardly credit that so much damage could be done by a cancerous growth as was done in this case. The smell was excessively fetid. The lips of the ulcer were now much thickened and indurated, and the cavity of the ulcer was about one or two inches deep in different parts. The surface was papillated, the papillæ being of a reddish-yellow colour, and the growth was hard, and discharged a most offensive and acrid fluid. The swelling proceeded from the ulcer downwards to the mammary gland, in which were places where suppuration was going on. The mammary gland broke out into deep fistulous sores, and all the neighbouring structures, the soft parts of the thighs and so on, were very much swollen. It was counselled that the animal should be shot; but the owner did not like to carry out this extreme measure.

About six weeks after my third visit the mare died.

CHAPTER X.

DISEASES OF THE NERVOUS SYSTEM.

GENERAL REMARKS ON THE STRUCTURE AND FUNCTIONS OF THE NERVOUS SYSTEM, AND ON THE LOCALIZATION OF NERVOUS DISEASES.

We do not purpose here to enter into the anatomy and histology of the nervous system, but to cursorily review some general points which are of especial importance in the study and in the localization of the diseases of the nervous system.

The nervous system is made up of two ultimate factors, nerve-fibres and nerve-cells, and these are intimately associated together.

The white matter of the brain and of the spinal cord is composed of nerve-fibres imbedded in a ground substance, or neuroglia. The grey matter of the brain and spinal cord is made up of nerve-fibres and of nerve-cells, or 'ganglion cells,' as they are termed, similarly imbedded in the neuroglia.

The neuroglia itself consists of three different kinds of elements—(1) a homogeneous, transparent, semi-fluid *matrix*, which in hardened sections appears more or less granular; (2) a network of very delicate fibrils, '*neuroglia fibrils*,' which resemble elastic fibres; (3) small branched nucleated cells interwoven into the network of the neuroglia fibrils. These are termed the *neuroglia cells* (Klein).

Now, the nerve-cells alone are capable of exhibiting independent nervous activity.

They are the receivers of impressions and the generators of nerve-force, and therefore the true physiological nerve-centres are exclusively confined to the grey matter. The nerve-fibres only serve to conduct impulses to and from the nerve-centres with which they are in connection.

Cerebro-Spinal System.—On a vertical section of the hemispheres of the cerebrum, each convolution of the brain shows a white centre composed of medullated nerve-fibres and a grey cortex.

The white matter of the convolution is arranged (1) as a central mass—the centrum ovale, from which the lamina of white matter for each convolution branches off, and (2) the commissure of white matter between the two hemispheres, *i.e.*, the corpus callosum, and the anterior commissure (Klein).

The centrum ovale consists of (*a*) tracts of medullated nerve-fibres which connect the convolutions of the same hemisphere with one another, and (*b*) those passing between the convolutions on the one hand, and the thalamus opticus, the pons varolii, and the medulla on the other.

From the whole of the cerebral surface, therefore, white fibres radiate to the large ganglia at the base.

A special part of the corpora striata, termed the internal capsule, chiefly receives filaments from the anterior half of the brain, and these are concerned in the transmission of motor impulses. They pass through the ‘crusta’ of the crura cerebri, and thence along the motor tracts of the cord. The other ganglia at the base mainly receive fibres from the posterior part of the brain, and are chiefly concerned with sensory functions. These fibres pass through the tegmentum of the crus, and thence along the sensory tracts of the medulla and cord.

The motor fibres, on reaching the medulla oblongata, decussate or cross over to the opposite side, pass down the anterior and lateral columns of the cord, and emerge by the anterior roots of the spinal nerves. The sensory fibres enter the cord by the posterior roots of the spinal nerves, cross immediately to the opposite side, thence pass upwards to the medulla, and onwards in the way above indicated.

If, therefore, one half of the cord below the medulla be destroyed, loss of motion on the same side as the lesion and loss of sensation on the opposite side, would follow. Destruction of one half of the brain would cause loss of motion and sensation on the opposite side to that of the lesion. Pathological observation and recent experimental researches have shown that combined movements uniformly follow excitation of certain areas of the cortical surface, and that destructive lesion of the same parts is followed by paralysis of special groups of muscles. But for further particulars of these special centres we must refer the reader to Dr. Ferrier 'On the Functions of the Brain,' or to Dr. Foster's 'Physiology,' in which a very clear account of the localization of cerebral functions is fully given.

Seeing that the structure of the brain is far less complex in the horse than in man, and that it forms, as the following table of Colin will show, a much lower proportion to the rest of the body, diseases of the nervous apparatus are of far less frequent occurrence in the equine species than in ourselves.

Table indicating the weight of the encephalon and spinal cord as compared with that of the body (Colin).

Animal.	Weight of Body.	Weight of Brain.	Weight of Medulla and Pons.	Total Weight of Encephalon.	Weight of the Spinal Cord.	Weight of Cerebellum.	Weight of Encephalon and Spinal Cord.	Relation between the Weights of the Encephalon and Body.	Relation between the Weights of the Cerebro-spinal Axis and Body.
Stallion ..	382·0	494	46	616	304	76	920	:: 1 : 620	:: 1 : 415
Gelding ..	380·0	559	39	675	300	77	975	:: 1 : 563	:: 1 : 389
Mare ..	408·0	510	34	615	269	71	684	:: 1 : 663	:: 1 : 461
Ass.. ..	175·0	316	24	385	159	45	544	:: 1 : 454	:: 1 : 321
Hinny ..	186·0	466	31	564	198	67	762	:: 1 : 329	:: 1 : 244

The anterior portion of the surface of the brain appears to be the supreme organ of the cerebro-motor processes or impulses, whereas the posterior portion of the cerebrum is similarly related to sensation. The part of the cerebrum anterior to the motor tract is chiefly concerned with the manifestation of intelligence.

Besides the ganglia already mentioned at the base of the brain, which include the corpora striata, the optic thalami, the corpora geniculata, and the corpora quadrigemina, there are collections of grey matter constituting a series of subordinate centres, closely succeeding each other, from the corpora quadrigemina above to the termination of the cord below, each either giving origin to motor or receiving sensory fibres. Each centre is also capable of independent action in connection with reflex or automatic movements. The most important function of the cerebellum is the co-ordination of voluntary movements. It has been held that it presides over the reproductory functions, but several facts oppose this view. M. Leuret showed, by taking the averages in ten stallions, twelve mares, and twenty-one geldings, that the weight of the cerebellum is greatest in the latter.

	Average.	Highest.	Lowest.
Stallions ..	61	65	56
Mares......	61	66	58
Geldings..	70	76	64

Experimental lesions of the cerebellum always induce disorders of equilibrium, but never impairment of sensation or actual loss of voluntary muscular power, and Flourens inferred, therefore, that it controlled and harmonized the various muscular movements, while Foville attributed the manifestations to loss of muscular sense.

Sympathetic System.—The chief function of the sympathetic system is the control of the involuntary muscle-fibre of the body.

If the branches of the sympathetic supplying the muscle be stimulated, contraction is caused, while section of the nerve is followed by relaxation of the fibres.

In this manner the calibre of the bloodvessels and the amount of the blood supplied to various organs and tissues is regulated.

In addition to this indirect influence of the sympathetic upon the nutrition of the tissues, it is very probable that it also exercises a direct influence on the functional activity of the cells in secreting glands and elsewhere.

The sympathetic system appears to have its supreme centre in the medulla, or rather in its floor; but it is intimately interwoven with the spinal system, for each spinal nerve receives branches from and transmits branches to the neighbouring sympathetic ganglion.

CONVULSIONS AND SPASMS.

The term convulsion, in its most extended sense, indicates any spasmodic contraction beyond the control of the animal.

Convulsions may affect a single muscle, or a group of muscles, a limb, or the whole or one half of the body.

They vary in intensity, from a mere 'tremor' or 'trembling' of a single muscle to the most violent contortions of the whole body.

Convulsions may be considered under three groups:

1. **Tremors.**—Tremors may accompany voluntary movements, or may occur independently. The tremors from cold or mercurial poisons are good examples of the latter.

2. **Choreic Movements.** — The disease termed chorea furnishes the most typical example of this kind of convulsion. Choreic movements are characterized mainly by their abruptness and irregularity, and by the fact that when engrafted on any voluntary movement, they interrupt its progress by a series of contractions which are not then necessarily limited to the limb or organ which is making the effort (Bristow).

3. **True Convulsions.**—They may arise from direct irritation of the nerve-centres, and also from irritation in remote parts.

Convulsions are clonic or tonic.

Clonic convulsions are intermittent and irregular, and those occurring in epilepsy will serve as an example. Tonic spasm consists in more or less sudden muscular contraction, and is exemplified in tetanus and strychnia poisoning.

MOTOR PARALYSIS—PARESIS.

By paralysis is meant the impairment of that power which the various motor centres normally exercise over the movements of the muscles.

The term 'paresis' is often used of the slighter forms of this condition.

Paralysis of the voluntary movements, which we now propose to consider, may be complete or incomplete.

Motor paralysis has special designations, in accordance with the parts invaded:

1. **General Paralysis.**—Is very rare in the horse, occurring only as a temporary condition in certain diseases of the cerebral structure, in cerebral congestion, in effusion into the basal ganglia, and in injuries and diseases of the anterior part of the cord and medulla oblongata.

2. **Hemiplegia.**—Hemiplegia strictly implies a paralysis of all the muscles of one half of the body; but in this perfect form it is never met with in man or animals.

Hemiplegia is very rarely observed in horses. It is usually the result of hæmorrhage or tumours affecting one half of the brain.

As a result of such changes, the angle of the mouth may become relaxed and the facial expression on the same side as the pathological lesion may be changed. The tongue may be protruded, and there is difficulty in drinking and in mastication. Deglutition is not impaired.

The animal may not lose the power of standing, but the power of progression is much affected.

The paralysis of the body is on the opposite side to that on which the cerebral lesion occurs. This is owing to the decussation of the motor fibres in the medulla oblongata.

The horse may regain power in a few days, but recovery is rare.

Those cases which end in recovery probably depend upon temporary inflammatory action, or other causes.

3. **Paraplegia.**—Paraplegia commonly depends on disease of the spinal cord, and denotes a defect or loss of power in all parts below the level of the lesion.

This affection is the commonest form of paralysis in the horse.

Causes.—The causes of paraplegia are:

1. *Central Nervous Lesions.*—These are due to injury, as fracture, or to diseases of the vertebræ, involving the spinal cord, or to disease of the cord itself.

2. *Reflex, or Functional Causes.*—Functional paraplegia depends upon alterations in the quality of the blood, as in lead poisoning, azoturia, and after feeding upon rye-grass; or it may depend upon intestinal or other disturbances of the system.

Paraplegia resulting from the ingestion of rye-grass (enzoötic paraplegia) will be considered fully below.

4. **Local Paralysis.**—Local paralysis is very rare in the horse, and is usually due to injury of a nerve from pressure by badly fitting harness or by some abnormal growth. It may also be due to disease of the nerve at any part of its course, from its connection with the nerve-centre to the organ supplied; but paralysis resulting from this cause is very uncommonly met with in the horse. The most common form of local paralysis in the horse is that of *the branches of the facial nerve, by which the muscles of the face are chiefly supplied with motor fibres.*

In paralysis of this nerve the lips are pendulous, and the animal is unable to grasp his food and has difficulty in mastication.

HYPERÆSTHESIA, DYSÆSTHESIA, ANÆSTHESIA.—By **hyperæsthesia** is meant exalted sensibility; by **dysæsthesia**, persistent or painful sensibility.

Practically, exalted sensibility is scarcely, if ever, distinguishable from painful sensibility. The hyperæsthetic eye cannot bear light, and the hyperæsthetic skin is sensitive to the slightest pressure.

The term 'dysæsthesia' includes the sensations of itching, numbness, burning, cutting, constriction, and various other kinds of pain. The agony of enteritis, and several other diseases of the bowel and other organs, are especially acute in the horse.

By **anæsthesia** is meant impairment or loss of sensation. Hyperæsthesia and anæsthesia are usually met with together, associated with motor paralysis.

COMA AND INSENSIBILITY.

Under this heading we do not purpose to discuss the affection spoken of as 'sleepy staggers,' sometimes termed 'coma,' but to consider coma in its more general and extended sense.

Coma is a progressive loss of function, which begins at the cerebrum, and is characterized at the outset by loss of consciousness, perception, and voluntary movement.

Automatic and reflex movements continue at first; but when the large ganglia at the base of the brain become involved, the capacity for automatic movement becomes more and more limited.

In fatal cases, the loss of function progresses, and gradually extends to the medulla, which is the seat of the respiratory, circulatory, and other centres.

Death then soon ensues.

The causes of coma are intense congestion or anæmia of the brain, altered conditions of the blood, and injury or compression of the brain.

STAGGERS.

To several affections of the horse the term 'staggers' has been applied at various times by different authors.

Indeed, there are at least as many as five distinct affections which have received this name, and there are many more of which 'staggers' is a feature.

Staggers may be due to *primary disease of the nerve-centres, or to influences affecting them from disease of other organs.*

Varieties:—

1. **Mad Staggers.**—The condition termed 'mad staggers' may depend upon various causes. In the first place frenzy, or violent uncontrollable fury, may be caused by inflammation of the membranes of the brain, or the brain itself, or of both together. The frenzy-stage, or stage of irritation, occurring in meningeal inflammation, though undoubtedly also present in some cases of pure cerebritis (*vide* next article), is not such a constant feature as in the former disease.

After the frenzy-stage, as the disease progresses, stupor, coma, and paralysis may supervene.

Mad staggers, or frenzy, may also be due to uræmic poisoning, to rabies, or to melanotic deposits in the brain.

Again, staggers resulting from engorgement of the stomach may be so severe as to admit of being termed 'mad staggers.' Staggers dependent upon functional disturbance is not followed by coma and paralysis, as it is when dependent upon encephalitis, nor is it accompanied by febrile manifestations, as in the latter case.

2. **Stomach Staggers.**—This affection is otherwise known as acute indigestion or impaction of the stomach, and has already been described. Stomach staggers is sometimes termed 'sleepy staggers,' or 'coma.' Sleepy staggers, or coma, manifested by staggering gait; slow pulse and deep respirations may be, however, and frequently is, dependent on actual cerebral mischief.

3. **Grass Staggers.**—This affection is due to eating ryegrass, and will be described under 'Reflex or Enzoötic Paraplegia.'

4. **Epilepsy.**—Epileptic attacks have been confounded with staggers depending upon secondary cerebral disturbance due to reflex irritation.

5. **Megrims and Vertigo.**—This affection, which is usually

due to irregularity or disturbance of the cerebral circulation, has been described as staggers.

SECTION I.

DISEASES OF THE BRAIN.

ACUTE INFLAMMATION OF THE BRAIN AND ITS MEMBRANES.

Synonyms.—Encephalitis, cerebritis, phrenitis, meningitis.

Acute inflammation of the cerebrum, or hemispheres of the brain, termed cerebritis, encephalitis, or phrenitis, is usually associated in the horse with meningitis, or inflammation of the meninges or coverings of the brain; and we therefore describe these two affections together.

Etiology.—Inflammation of the brain and of its coverings is usually due to direct injury, as blows on the head, or to disease of the bones of the cranium.

This inflammation sometimes supervenes in some of the specific fevers, and may also be due to exhaustion or exposure to the heat of the sun.

Horses may occasionally be attacked, especially, it seems, cart-horses, without any perceptible cause.

Of epizoötic cerebro-meningitis, or cerebro-spinal fever, we have already treated.

Symptoms.—Practically, it is almost impossible to distinguish between inflammation of the brain itself and inflammation of its membranous coverings, and, indeed, as we have already intimated, these two affections are usually associated together.

When the membranes of the brain are primarily affected, the symptoms are characterized by the suddenness of their onset. They consist at first in great excitement, with convulsions or spasms, and are followed by a stage of depression.

Encephalitis is not characterized by such a sudden onset, and is said to be marked by no frenzy or excitement, but from the first exhibits lowered or depressed functional activity.

But in some instances of encephalitis, at any rate, the stage of depression is preceded by one of irritation, as in meningitis. We ourselves have observed two instances, corroborated by the post-mortem examination, in which localized encephalitis was ushered in by the manifestation of violent and uncontrollable frenzy.

Nevertheless, great excitement and convulsions are especially characteristic of meningeal inflammation as distinguished from pure encephalitis.

The symptoms of meningo-encephalitis vary much in accordance with the extent of the tissue inflamed, and its seat.

The temperature in this affection is high, and the febrile manifestations are strongly marked. The appetite is capricious, and the bowels are confined.

The animal is very intolerant of its head being handled or pressed upon, and the skin and mouth are hotter than natural.

The eyes are staring and the pupils are contracted, though in the later stages of the disease they become widely dilated. The pulse is accelerated; the artery is full, firm, and hard, and the respirations are quickened and irregular.

The urine is diminished in amount, and is of darker colour than in health.

The horse moves to and fro restlessly, and his body is sometimes bedewed with perspiration.

Occasionally muscular twitchings and general or local hyperæsthesia are manifested.

The stage of excitement is of variable duration, and the symptoms manifested in it differ widely in intensity.

It is followed by the stage of depression, which is characterized by stupor and coma, caused by more serious involvement of the true nerve-centres.

The differences between cerebral and meningeal diseases in the human subject are arranged as follows by Aitken:—

Cerebral Disease.	Meningeal Disease.
1. From the outset, or from a very early stage of development, there is loss of some one or more of the proper nervous functions, such as paralysis, anæsthesia, loss of memory.	1. It is not till some time after the detection of signs of disease that diminution or loss of nervous function takes place.
2. Cerebral disease is not commonly attended by high-marked exaggeration of function, such as furious delirium, convulsions, intense hyperæsthesia or tenderness.	2. The subsequent diminution or loss of nervous function, which succeeds the prolonged existence of 'head symptoms,' is generally preceded in cases of meningeal disease by extremely severe excitement or exaggeration of functions, such as pain, tenderness, furious delirium, or convulsions.
3. Little vascular excitement attends cerebral disease, nor is there frequently any highly-marked general disturbance.	3. In meningeal affections there is usually much local vascular excitement, with general disturbance.
4. Paralysis and anæsthesia, losses of volition, ideation, perception, and the like, characterize cerebral disease.	4. Spasms or convulsions, pain and delirium, are the general features of meningeal disease.

Morbid Anatomy.—When the membranes of the brain are involved in the inflammation, the pia mater is thickened, opaque, and much congested over a larger or smaller area. The dura mater may be adherent in parts to the cranial bones.

Inflammation of the brain itself is usually limited to one or more patches, and, as in man, is more commonly met with as the result of injury or disease of the cranial bones. The inflamed brain-substance is sometimes much altered, but may be at first red and congested, afterwards becoming pulpy and disorganized, with congestion and œdema of the surrounding nerve-tissue.

The inflammation may subside, or terminate in suppuration.

The abscess when formed is generally single, but there may be several in pyæmia.

In a case recently before our notice, which was ushered in by violent frenzy, followed shortly by great depression, coma, and death, a large abscess was found occupying a large area of the right cerebral hemisphere.

Treatment.—Bleeding is indicated in inflammation of the brain and its membranes when the fever is high and the excitement and restlessness very marked.

In cases of inflammation of the structures occurring in the course of a specific fever, or in some primary constitutional disease, bleeding is generally harmful.

In all cases, a cathartic should be given at once, as soon as the case is seen.

Locally, ice, or cloths steeped in cold water or some evaporating lotion, should be applied to the head during the stage of excitement. The animal should be removed from all noises, and kept as strictly quiet as is possible.

Internally, liquor ammoniæ acetatis and potassium bicarbonate may be given three times daily.

In the stage of irritation, potassium bromide or chloral hydrate may be given in addition.

These remedies may be given in the water, if the animal continues to drink.

The diet should be light and nutritious.

If paralysis and impaired sensation still continue after the abatement of the acute symptoms, a smart blister may be applied to the poll, and should be repeated if necessary.

It is, if possible, much the best plan to place the horse comfortably in slings from the first onset of the disease. Horses will have a much better chance of recovery if they be placed in slings.

CHRONIC DISEASES OF THE BRAIN.

CHRONIC MENINGITIS.—Chronic inflammatory changes are sometimes met with in horses in the membranes of the brain, but during life they are not usually diagnosed. They may give rise to general dulness, a staggering gait, slow pulse, and other symptoms, as well as sometimes to the more active manifestations of cerebral disturbance.

Chronic meningeal inflammation is usually the sequel of acute attacks of inflammation, or it may follow recovery from various injuries to the brain.

CEREBRAL SOFTENING.—Cerebral softening is usually the result of embolism of the cerebral arteries, but it may also follow inflammation of the brain substance. It sometimes occurs as a result of plugging of the cerebral arteries in pink eye or pneumo-enteritis.

The symptoms manifested during life, though not diagnostic, are similar to those met with in tumours and chronic meningeal disease of the brain, and were spoken of by the older writers as 'coma,' or 'sleepy staggers.'

If the softened patch of the brain substance be examined, it will be found variously altered.

It will be white, yellow, or pinkish in colour, and of variable consistency.

Softening, due to arterial plugging and atheroma, is usually met with in old animals.

HYDROCEPHALUS. — Hydrocephalus (ὑδωρ, water; κεφαλη, the head), or effusion of fluid into the ventricles of the brain alone, or into or beneath the arachnoid in addition, is of not uncommon occurrence in the horse.

In rare instances it is said to be met with sometimes in old animals, but is more frequently met with as a congenital defect in foals.

Its pathology is obscure, but when occurring in adults, it is probably, as in man, dependent upon pressure on the venæ galeni (D. Gresswell).

When occurring as a congenital defect, it is probably due to some constitutional cachexia in one or both parents.

Symptoms.—The symptoms of hydrocephalus may be arranged under two groups :—

1. *The Appearance of the Head.*—The hydrocephalic head is recognised by the great enlargement of the volume of the cranium.

The face appears very small by contrast, and the fontanelles and sutures are wider than in the normal condition.

Dr. Fleming, in his excellent 'Text-Book of Veterinary Obstetrics,' gives the following description of this unsightly condition :

'In some cases the distension has been so slight that the frontal bones are not much raised, while in others the collection of serum has been so great that these and other bones of the cranium are displaced, and the forehead, rising almost at right angles to the face, suddenly reaches an extraordinary height, giving the creature a startling appearance. The hydrocephalic tumour varies in figure as well as in volume. It is sometimes quite globular, and protrudes so high and so much over the face as to give the physiognomy a strangely human appearance ; in rare cases it is narrow, but excessively protuberant, involving only a part of the cranium ; at other times it is bilocular, and the divisions may be either alike or unequal in volume.

'Not unfrequently the diameter of such a tumour in the calf measures more than half a foot. The tumour is soft and depressible in parts, hard and resisting in others, owing to the bones of the cranium being altered and separated in places.

'These bones, and particularly the frontal, temporal and parietal, are, as a rule, considerably deformed and thrown out of their natural direction, and in places so expanded and rarefied as to be no thicker than tissue paper. When the internal distension has been very considerable, their borders do not meet as in their normal condition, but are often widely separated, leaving between them vast fontanelles, occupied only by a thin translucent membrane, the dura mater, which is in immediate contact with, and closely adheres to, the skin.

'In some instances, especially in the calf, the bones on their upper part do not join at all, and the roof of the cranium, or rather of the cranial tumour, is entirely absent. In other instances, and particularly in the foal, a kind of bony arch extends from the nasal to the occipital bones, in the direction of the sagittal suture, with only here and there, on each side, small osseous patches from the parietal or temporal bones, and adhering to the dura mater.

'The tumour is always entirely covered by intact, though sometimes very thin skin, to which the hair is ordinarily attached, and is, indeed, at times longer than usual, especially at the sides.

'Owing to the great development of the forehead, the upper jaw appears to be shorter than usual; and, indeed, it will be found that it is really so.'

2. *General Symptoms.*—In the early stages the animal is irritable, and manifests febrile symptoms. Afterwards the foal becomes weak and debilitated, and its sensibility becomes impaired. Paralysis, coma, and convulsions precede death in fatal cases.

When hydrocephalus comes on in adult life, the symptoms are occult; but fortunately this disease is of rare occurrence, except as a congenital defect.

Prognosis.—Cases of recovery from congenital hydrocephalus are very rare, even in the mildest forms of the disease.

Morbid Anatomy.—The ventricles are found distended with a varying quantity of clear limpid or slightly yellow or greenish serum. The lining membrane of the sac is often rough and granular. The quantity of fluid varies very considerably, but is generally from two to four pints in the foal and calf.

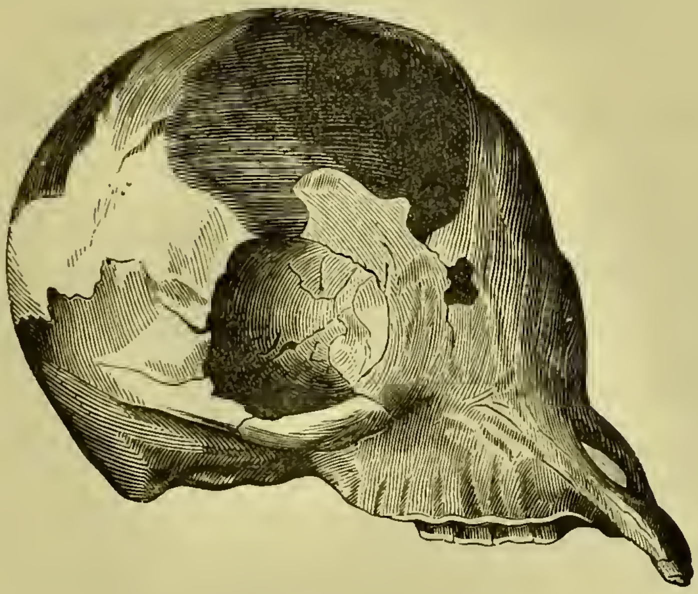

Fig. 4.—Head of Hydrocephalic Foal (from Fleming's 'Veterinary Obstetrics.'

The late Mr. D. Gresswell collected as much as five and a half pints in one instance, and over eleven in another.

The largest amount recorded is two and a half gallons.

The accumulation of the fluid within the ventricles flattens the cerebral convolutions, and may almost entirely obliterate them, and the hemispheres are more or less completely destroyed.

The spinal cord, choroid plexuses, and cerebellum are not generally affected.

Treatment.—Even in the most favourable instances there is little profit to be derived from keeping hydrocephalic foals, as they are mostly very weakly, badly developed, and do not thrive well.

TUMOURS IN CONNECTION WITH THE CEREBRAL STRUCTURES.

TUMOURS IN CONNECTION WITH THE CRANIAL WALLS.

EXOSTOSES.—Osseous tumours, or ivory osteomata, have sometimes been met with growing from the internal, and also from the external, plates of the cranial bones of horses. They generally grow from the internal surface of the temporal bones, and are rounded, nodulated, and sometimes pedunculated.

They are hard and dense, being composed of compact ivory-like tissue, containing osseous corpuscles, but no Haversian canals or blood-vessels.

In some cases they become detached from the cranial walls, and lie loose in the cranial cavity.

TUMOURS IN CONNECTION WITH THE BRAIN AND ITS MENINGES.

1. TUMOURS OF THE CHOROID PLEXUS.—Abnormal growths in connection with the choroid plexus of the lateral ventricles are the most frequently encountered of all cerebral tumours in the horse.

They sometimes involve one of the plexuses, sometimes both, and are frequently symmetrical on both sides of the brain, not only in position, but in size also.

These tumours develop very slowly, and do not occasion severe symptoms until they have attained a size perhaps as large as a pigeon's egg. They are sometimes met with as large as a hen's egg. They occur in horses of various ages, but are more common in old animals. The tumours are composed of cholesterine* ($C_{26}H_{44}O$), of calcareous particles termed 'brain sand,' and a little serum. They are enveloped in the folds of the choroid plexus, encapsuled by a more or less dense membrane, and held together in many instances by fibrous tissue in variable amount.

These tumours are developed in connection with hypertrophied villi of the choroid plexus, which are frequently enlarged and congested in old horses. Sometimes they are made up almost entirely of cholesterine arranged in spherical masses, and are probably due to caseous and calcareous degeneration of inflammatory exudation thrown out by the processes of the plexus.

The calcareous particles are contained in concentric bodies called corpora amylacea, and are termed 'brain sand.'

These concentric bodies, held together by fibrous tissue, are sometimes met with in the brain and its membranes in man, and are termed 'psammomata' (from ψαμμα, sand). In some instances these calcareous bodies form a large part of the tumours in horses, while in others cholesterine is the chief constituent.

The lateral ventricles may be almost, or quite, filled by the tumours, and not uncommonly congestion and other signs of recent inflammation of the neighbouring parts may be observed after death.

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* Cholesterine, a normal constituent of the bile and various tissues, especially the nervous, is a neutral substance which readily crystallizes from an ethereal solution in rhombic plates, which, when seen in mass, have a mother-of-pearl lustre. It fuses at 145°, is insoluble in water but soluble in alcohol, ether, and chloroform. When evaporated with nitric acid, the residue on addition of ammonia acquires a dull red colour. If sulphuric acid be added to an equal amount of solution of cholesterine in ether, the solution becomes red, then purple, while the subjacent layers acquire a distinct green fluorescence. Cholesterine is the chief constituent of gall-stones, and occurs in several other pathological products.

2. **CANCER.**—Cancerous growths are said to have been met with in rare instances in connection with the meninges and substance of the brain. When occurring here, these growths are nearly always due to secondary infection from primary cancerous disease of other organs of the body.

3. **MELANOSIS.**—Melanotic growths are sometimes observed in connection with the meninges and brain substance of the horse. Mr. Williams mentions a case in which black melanotic nodules were observed in the brain and membranes of an aged grey stallion which had suffered for some time from stringhalt. These nodules were also found along the spinal cord, and were especially numerous in the lumbar region.

4. **GLIOMA.**—Glioma is a variety of round-celled sarcoma, growing from the neuroglia of nerve-tissue. It consists of small round cells, and has been met with by Mr. Robertson on several occasions in connection with the cerebellum as an ill-defined tumour.

We have met with some patches of firm dense greyish tissue in connection with the cerebellum, but on examination they proved to be merely patches of sclerosis, no cells of a sarcomatous nature being found.

5. **FIBROMA.**—Fibromata have been sometimes observed in connection with the meninges of the brain.

6. **PARASITIC GROWTHS** are sometimes met with in connection with cerebral structures (vide Chapter on 'Entozoa).'

SYMPTOMS OF TUMOURS IN CONNECTION WITH THE BRAIN AND ITS MENINGES.

Tumours of the choroid plexus scarcely ever affect the health of the animal or give any signs of their presence until they have reached a size perhaps as large as a walnut or hen's egg.

When they have attained such a size, they may give rise at varying intervals to severe convulsive fits, staggering gait, and inability to perform work. In other instances no symptoms are manifest before a fatal stroke resembling apoplexy from rupture of a cerebral artery suddenly occurs. Sometimes the animal becomes violently excited, raises its head, and dashes violently forward. In these instances the head is hot, the pulse is full and bounding, and the vision is imperfect. After a while the paroxysm may be relieved, and the animal rises and regains consciousness.

When symptoms are manifested prior to the sudden attacks, there may, in some instances, be unconsciousness, with elevation of the head and fore-part of the body, while in others there is a tendency to keep the head depressed (Williams).

These tumours generally grow for a long time without producing any untoward symptoms, which mostly come on quite suddenly when the tumour reaches the size of a large egg.

All intra-cranial tumours may give rise to staggering gait, a tendency to fall asleep and become drowsy while eating, slow pulse and deep respiration—an aggregation of symptoms spoken of by the old writers as '*sleepy staggers*,' or '*coma*.'

Violent exertion is always liable to be attended with symptoms of cerebral disturbance indicated by the above manifestations, or by more active signs, as uncontrollable excitement and frenzy. In some instances abnormal growths in the brain are also injurious in virtue of their being part of a general disease of the system, as, for example, in the case of melanosis or other malignant growths.

TREATMENT OF TUMOURS IN CONNECTION WITH THE BRAIN AND ITS MENINGES.

Drugs are of no avail in the treatment of these tumours, but careful management of the work and dietetic arrangements is in many instances attended with marked benefit.

DISEASES DEPENDING UPON ALTERATIONS IN THE CEREBRAL CIRCULATION.

MEGRIMS, OR CEREBRAL HYPERÆMIA.

We have already alluded to 'megrims,' or cerebral congestion, as being spoken of with other cerebral disturbances of an organic or functional character, as 'staggers' or 'vertigo.'

Definition.—By megrims we understand that form of cerebral disturbance usually sudden in onset, of short duration, liable to recurrence, and characterized by excitement, perversion or impairment of special sensation, but also to some extent of common sensation and voluntary motion (Robertson).

This form of cerebral disturbance is liable to be confounded with organic disease of the brain.

Etiology.—Cerebral congestions may be mechanical (or passive) or active.

Passive congestion is generally due to interference with the escape of the blood from the cranial vessels.

Active congestion may be due to increased cardiac activity or to disturbance of the vaso-motor influence, or may be associated with general plethora, or with any interference with the general arterial or capillary circulation.

Megrims occurring in harness or draught-horses, except when due to organic cerebral disease, is almost always due to mechanical impediment to the flow of the blood from the brain, occasioned by the pressure of too tightly or badly fitting harness.

By some megrims is believed to be due to inflammatory action.

It is said also that megrims may be produced by exposure to the rays of the sun, or by driving fast after a heavy meal.

These causes certainly may increase the tendency to this affection, but it is very improbable that they alone can cause it. As already pointed out, however, indigestion is liable to be caused by fast driving after heavy meals, and may induce vertiginous symptoms, which might easily be confused with megrims depending upon actual congestion.

Symptoms.—There are generally no premonitory symptoms, the attack being sudden in its onset.

The animal slackens its speed, or stops suddenly, and moves its head from side to side or up and down. Sometimes its head is turned to one side.

The vessels of the face and throat are engorged, the eyes stare, the nostrils are dilated, and the breathing is rapid. The skin may be bedewed with perspiration, and the cervical and facial muscles twitch convulsively.

If the collar causing the obstruction be removed, the symptoms abate, and the animal soon recovers.

When the symptoms are very severe, there is great excitement, the convulsions become still more severe, and the animal falls prostrate to the ground.

Morbid Anatomy. — The brain is found congested, and the venous sinuses and vessels are engorged. The capillaries of the pia mater are full of blood, and the brain-substance, when cut into, presents a large number of red spots, and is redder than natural.

Treatment.—First remove the collar to permit of the return of the blood to the heart, and then apply cold water to the head.

When the affection depends upon gastric disturbance, this must be treated as already directed (*vide* 'Diseases of the Stomach').

In those instances where the neck is peculiarly shaped, it may be necessary to use a breast-strap instead of a collar.

CEREBRAL ANÆMIA.—Anæmia of the brain of the horse may depend upon general anæmia, feeble action of the heart, or upon local interference with the blood-supply from intra-cranial obstruction. The brain and its membranes become paler than natural, and occlusion of some of the small vessels may be observed. When dependent on general anæmia, the symptoms are early exhaustion, general pallor of the visible mucous membranes, and dilated pupils.

In partial anæmia the symptoms vary in accordance with the nature of the cause.

The Treatment of anæmia of the brain, when due to general anæmia, consists in attention to the hygienic conditions, good nutritious diet, and the administration of iron and vegetable tonics.

CEREBRAL EMBOLISM AND THROMBOSIS.

Cerebral embolism denotes a plugging of one of the arteries of the brain by a small vegetation or fragment of fibrin detached from the heart or aorta, and swept off into the current of the circulation. The embolism may also be due to detachment of fragments of pulmonary thrombi.

Cerebral thrombosis is almost always associated with an unhealthy condition of the inner coat of the vessels, or to a diseased condition of the blood itself.

Embolism and thrombosis cut off the supply of blood from the part of the brain to which the diseased vessel is distributed, and cerebral softening ensues.

CEREBRAL HÆMORRHAGE, OR APOPLEXY.

Cerebral hæmorrhage is due to rupture of a vessel in the brain. Rupture of cerebral arteries is generally due to disease of the walls or to changes in the surrounding parts by which the vessels are deprived of support, or finally to injury. Cerebral hæmorrhage is very rarely met with in the horse.

Symptoms.—In some instances there may be premonitory symptoms, but generally the horse suddenly loses consciousness and falls prostrate to the ground.

The extravasation, if occurring on one side of the brain, gives rise to partial or complete hemiplegia, or a certain set of muscles, or one limb only (monoplegia) may be paralysed, in accordance with the extent of destruction of the cerebral substance. The symptoms vary in accordance with the part of the brain affected, and in rare instances, owing to increasing hæmorrhage, may take some days before they are fully developed.

The breathing is stertorous and the pupils are usually dilated and insensitive to light, and the animal is insensible to external surroundings.

The pulse is rapid and thready ; the limbs are flaccid, and the body is bedewed with a cold sweat.

When the lesion is very extensive, the coma is profound and the sphincters relaxed.

Prognosis.—When the hæmorrhage is extensive, it generally proves fatal. In less severe cases recovery may take place, but more or less impairment of voluntary motion may remain.

Morbid Anatomy.—Cerebral hæmorrhage in the horse occurs in the substance of the brain, but it may also occur in the meninges, especially when due to injury. When the hæmorrhage is recent, a red clot of variable size is found. This afterwards becomes encysted, and undergoes changes in colour and consistence, and hæmatoidin crystals and granular pigment are often found in it.

In other instances inflammatory changes, resulting in the softening of the cerebral structures, or abscess may be formed.

In old horses, the cerebral arteries will probably be found to be in an atheromatous condition.

Treatment.—In those instances of cerebral hæmorrhage where the coma is attended by full strong cardiac action in the young and previously healthy animal, bleeding is recommended.

In other cases, all that can be done is to apply cold to the head, which should be elevated a little to allow a good supply of fresh air, and to bandage the legs. If collapse should threaten, owing to intensity of the shock, stimulants may be administered through enemata. In all cases the bowels should be freely acted upon.

SECTION II.

DISEASES OF THE SPINAL CORD.

INFLAMMATION OF THE SPINAL CORD AND ITS MEMBRANES.—Inflammation of the spinal cord (myelitis), and of its coverings (spinal meningitis), may be described together, as in many instances both the cord and its membranes are simultaneously involved, and where the affection is mainly confined to one, it is often difficult to diagnose which of these structures is the chief seat of inflammation.

Etiology.—Spinal inflammation may be acute or chronic. Acute spinal inflammation may be due to injury, such as fracture or displacement of the vertebral segments resulting in compression of the cord.

When arising idiopathically, it is often very difficult to trace the cause, but hereditary predisposition is certainly in many instances traceable.

Exposure to cold and damp, especially after a heavy day's work, are potent causes of inflammation of the spinal cord, and of its membranes.

Symptoms.—Premonitory symptoms are more likely to be manifested when the membranes are the special seat of inflammation, whereas they are more likely to be absent when the inflammation is especially concentrated in the cord itself.

Before paralysis comes on, in cases of inflammation of membranes especially, spasmodic contractions of the large muscles connected with the trunk and limbs, chiefly the hind ones, are observed.

Febrile symptoms are manifested, and perspiration bedews the body. The legs are lifted up and placed upon the ground in quick succession. The animal suffers great pain, and is very restless and excitable, and is disturbed by the slightest movements of the attendants.

Now and again he may have intervals of calm and quiet, and cessation from spasms.

But after the lapse of eight to twelve hours or so, from the pain caused by progress of the inflammatory action, and from the exhaustion, the animal falls prostrate to the ground.

The spasms often continue as he lies, and in very severe cases gradually increase in frequency and intensity.

Sensation is much impaired in the limbs; the pulse is quick, and the artery full and firm; the respirations are accelerated, and the temperature is elevated.

The appetite is impaired, or lost altogether; the urine is more scant, and the bowels are usually confined.

In those instances where the inflammation is more probably seated in the cord itself specially, the mode of onset differs from the above.

No symptoms of spinal inflammation are observed in these cases until sudden interference with the power of locomotion attracts the notice of the attendants. The loss of motor power becomes in a very short time so complete that the animal is prostrate, and is unable to rise.

The muscular spasms, so prominent a feature in cases where the meninges are especially involved, are not so marked or so frequent in these cases.

Sensation is rarely, if ever, entirely destroyed, pain being felt when a limb is pricked. Pain, when severe, is associated, as indeed is severe pain of other organs, with acceleration of the pulse and respirations.

Symptoms of Chronic Spinal Inflammation. — The animal has tonic and clonic contraction of certain muscles, or sets of muscles.

The spasms often gradually increase in frequency and, indeed, in intensity, but are rarely of such a severe description as to prevent the animal from working.

They may afterwards subside, or pain and increased loss of power over certain sets of muscles may ensue, as well as rigidity or spastic contraction in different groups of muscles. The animal does not show any tendency to lie down, and, when down, has great difficulty in rising.

These symptoms slowly and gradually progress, and the loss of muscular power is often followed by complete paralysis of the posterior extremities.

In those instances of chronic inflammation of the spinal cord specially, as distinguished from that of the meninges, loss of motor power is mostly followed by more or less complete paraplegia.

Morbid Anatomy.—After death from acute spinal inflammation, the cord and its membranes are more or less congested, sometimes, indeed, very highly. The sub-arachnoid space is filled with serous exudation, and the cord, when cut into, is much redder than normal. The post-mortem changes, however, are sometimes very slight in comparison with the severity of the symptoms manifested during life, and they vary greatly in extent and in character.

In some instances the cord becomes soft and pulpy, the nerve-fibrils and cells undergo marked alterations, which are more especially, however, concentrated in the grey matter.

In chronic inflammation, the cord is red, injected, and softened ; the meninges are thickened, and the arachnoid is covered with inflammatory exudation, by which the two surfaces may become united, or the cavity is filled with reddish serum.

Diagnosis.—The history will in many cases help to clear up any doubts as to the diagnosis of the case. Acute spinal inflammation may be confused with azoturia. The dark colour of the urine in the latter affection, however, is not a feature of spinal inflammation, and the spasms are mostly limited to the gluteal region. In acute spinal inflammation a greater number and variety of muscles are usually affected, and the spasmodic contractions are of a more clonic nature.

Broken back is generally directly traceable to an injury, whereas spinal inflammation is mostly of idiopathic origin.

Prognosis.—Acute spinal inflammation usually terminates fatally.

Chronic inflammation does not generally end fatally, but so much loss of power remains in many instances that treatment is often abandoned.

Treatment.—A purgative, such as a full dose of aloes, should be administered at the outset, and the bowels should be kept carefully open during the progress of the disease by enemas, or the administration of saline purgatives.

Bleeding may be in many instances adopted, but it is contra-indicated when paralysis has set in.

Cloths wrung from hot water medicated by the addition of belladonna may be applied over the region of the spine to ease the pain and subdue the inflammatory action.

Internally, belladonna, in the form of extract or tincture, may be given three times daily.

After the acute stage is passed, ergot of rye, in the form of the ethereal tincture, and potassium iodide, may be tried, and where deficiency of nerve-power is left, stimulants may also be administered.

Externally, if impairment of nerve power remains, some authors recommend the application of the actual cautery over a considerable length of the spine, on both sides.

If blisters be used, cantharides should not be the active ingredient.

Internally, after the acute stages are over, strychnine and quinine may be administered three times a day.

In those cases where micturition is not easily performed, the catheter should be passed twice or three times daily, in order to draw off the urine.

The food should be good and nutritious, and the general hygienic conditions should be attended to.

SPINAL HÆMORRHAGE.

In rare instances, hæmorrhages in connection with the spinal cord have been met with from a diseased condition of the vessels. Generally, however, hæmorrhage is a surgical lesion, the result of direct violence.

The cord itself may be the seat of the hæmorrhage, or this may occur in the sac between the ensheathing meninges, or finally it may occur outside of the membrane.

If the extravasation into the substance of the cord be large, paraplegia may suddenly come on in consequence, but when it is of less extent, exaltation of functional activity may or may not be followed by impairment or loss of motor power.

TUMOURS AND ADVENTITIOUS GROWTHS IN CONNECTION WITH THE CORD.

Exostoses, melanotic growths and cancerous growths, are sometimes met with in connection with the cord.

We have already alluded to a case of melanotic deposits in the cord.

An account of a very interesting case of cancer of the spine is thus recorded by Mr. Hunting :

On the 10th September, 1855, I was requested to see a chestnut mare. the property of Mr. G. S. R., of S. H. She had been unwell for ten or twelve days with cough and sore throat ; her neck was likewise very stiff, but her appetite had remained good up to yesterday, when she became tympanitic, and suffered intense pain. When I saw my patient, I found that the pulse numbered 68, and was weak. The submaxillary artery appeared full and soft, and the action of the heart feeble. The breathing 59 in the minute, and rather laboured. The conjunctival membranes were very much injected, and of a yellowish colour. The mouth was hot and dry. The nostrils were greatly dilated. The ears were cold, legs warm. The fæces were of a healthy character. The respiratory murmur throughout the whole length of the trachea was much louder than in health, and the left lung gave evidence of partial congestion. The cough was thick and heavy, and of a peculiar sound, but not frequent. The larynx and trachea were very painful on pressure.

A watery fluid flowed from the eyes, but there was no discharge from the nostrils. The neck was very stiff, so much so that the animal could neither eat nor drink from off the ground, nor move the head in a lateral direction. The parotid glands were much larger and harder than usual. The appetite, however, was but little impaired.

From these symptoms I considered it to be a case of ordinary influenza, or distemper, which disease was exceedingly prevalent in the neighbourhood at the time. Acting upon this impression, I treated it as such until the 24th, when my patient was so much better, that professional attendance was no longer necessary. The head could now be moved with greater freedom in a lateral direction, and the mare was enabled to eat and drink from the ground. The breathing had become natural, both in character and frequency. The pulse 38, and healthy in tone, the appetite good, the animal lively, and capable of taking half-an-hour's exercise daily.

On the 6th of October I received a message to say that the mare was not so well. On arriving at the place late in the day, I found her apparently suffering but little pain, the intense agony which the owner had observed in the morning having passed off. The other symptoms they described as also existing were an enormously distended abdomen, frequent groaning, rigid limbs, an occasional lying down but quickly rising again, very heavy breathing, and an anxious expression of the eyes.

The pulse was 44 in number, and rather weak at the jaw; the sounds of the heart were so feeble that they were scarcely audible on the left side; the breathing was 66 in the minute, but not laboured; the motion of the abdominal muscles was indeed so slight, that I was unable to take the number of respirations at the flank; the neck was still a little stiff; the nostrils dilated, and much anxiety of the countenance present. The mucous membranes were healthy in colour; the mouth cool and moist; the surface of the body of a natural temperature; the bowels regular, and the urine of a light colour.

On the application of pressure to any part of the spinal region, from about the tenth dorsal vertebra to the sacrum, the whole of the voluntary muscles behind became as rigid and as hard as in the worst cases of tetanus during the periods of excitement. Very little difference could be detected in the violence of muscular contractions, whether the pressure was employed directly over the spine, or within twelve inches on either side of it. This tetanic rigidity sometimes occurred when pressure was not applied, and also when the animal was made to back, but then in a much less degree, and lasting for a few minutes only.

On an examination per rectum, I detected a large tumour on the left side of the spine, having a density, as imparted to the feel, equal to the structure of the liver. It appeared to be about eight or nine inches in diameter, three inches thick in its centre portion, and an inch at its circumference. It was closely connected to the posterior part of the kidney, over-lapping the posterior aorta, and extending to the right side of the spine. On pressing the enlargement, evident pain was obtained, but the tetanic spasm did not follow, nor was there the slightest indication of pain when pressure was applied to the inferior portion of the lumbar vertebræ. The pulsation of the posterior aorta between the tumour and the bifurcation of the vessel into the iliac arteries was scarcely to be felt, which I attributed to pressure of the enlarged mass upon the aorta.

I looked upon the case as one of very doubtful recovery, thinking that I had most likely to deal with the formation of an internal abscess as a sequela of influenza, which is not a very uncommon occurrence ; but my patient's appetite was good, the heart's action not much disturbed, and the fæces and urine healthy. I considered treatment justifiable. Counter - irritants were therefore applied to the loins, and pot. iodidum given internally with vegetable tonics. Under this treatment the tumour gradually became less in size, and much softer in consistence. The rigidity of the muscles was likewise less violent when pressure was applied to the spine.

On the 24th a ' charge ' was applied to the whole of the lumbar region ; mineral and vegetable tonics were daily given with the iodide of potassium, and exercise was enjoined.

From this date up to the 18th of November there was a gradual wasting away of the muscles; the appetite was generally good, the animal eating an average quantity of the most nutritious provender that could be obtained.

During this period the urine became highly impregnated with albumen, but which gradually diminished in quantity, until on the 18th of November, after which time I entirely failed to detect its presence.

On several occasions during the above period, the peculiar spasmodic contraction of the muscles, the tympanitic state of the abdomen, the anxious and protruding eyes, and the intense suffering would come on, but lasted only for a short time. These symptoms generally occurred two or three days in succession, and were not again seen for six or eight days.

On the 18th of November I found that the tumour was very much smaller, and also soft and flaccid. The pulse and breathing were perfectly natural, both in character and number. The spasmodic contraction of the muscles did not occur even when pressure was applied to the spine, and the animal looked more cheerful and lively.

From this date up to the beginning of December the mare slightly improved in condition, and I had more hopes of her ultimate recovery, but on the 6th of December the symptoms again returned, and in as bad a form as before. They continued for several days, and then disappeared.

On the 23rd of December, at eight o'clock in the evening, she was left apparently no worse. She drank an unusual quantity of water, and ate her food with avidity ; but early on the following morning she was found dead and cold.

Post-Mortem Appearances.—The thoracic viscera, the spleen and the liver, were all very pale in colour, but otherwise healthy. The left kidney was very much enlarged. The stomach, intestines, bladder, uterus, and right kidney were likewise healthy ; but the pancreas was filled with small tumours, varying in size from a pea to a walnut, which contained a yellowish jelly-like substance. The spinous processes of the lumbar vertebræ were extensively diseased. The second, third and fourth cervical vertebræ were extensively diseased. In the broad, flat spinous process of the dentata, there existed a circular aperture, extending from side to side, and from the arch to the top of the process at the point of its bifurcation. On the lateral and anterior part of the body on the left side the disease had made equal ravages, extending into the foramen at the base of the odontoid process. Immediately above the transverse process, on the same side, the destruction of bone extended from an inch and a half upwards and backwards, invading a nearly circular portion, and removing a large part of the articulation formed by the left half of the spinous process of the dentata and the anterior articular process in the third vertebra. At the antero-inferior part of the body of the bone, the disease had established a complete communication, nearly an inch in diameter, with the spinal canal, but the dura mater was not destroyed.

In all the affected portions there was a considerable quantity of bony material removed, forming large cavities, which were filled with a reddish-looking mass, presenting precisely the same appearances as those of the lumbar spine. In the third and fourth vertebræ the lesions were less extensive, but showed the same characteristic appearances.

Symptoms of Tumours of the Cord.—The symptoms of spinal tumours will necessarily vary much, in accordance with the seat and extent of the tissue invaded.

In many cases there is muscular spasm, followed afterwards by loss of motor power. There is pain on pressure over the seat of the tumours, and symptoms are of slow progress in most instances.

In those cases where symptoms of paralysis or loss of function are manifested, recovery cannot be hoped for, and treatment is of little avail.

SCLEROSIS OF THE NERVE-CENTRES.

By sclerosis of the nerve-tissue we understand an induration or hardening of the textures in varying extent and situation.

Sclerosis of the nerve-centres is not of common occurrence among horses. We have met with more than one instance of sclerosis affecting the cerebellum.

Mr. Robertson also records some instances affecting the cerebellum and the spinal cord in adult horses which had been subjected to hard work.

Etiology.—Hereditary predisposition, overwork, exhaustion, are among the chief causes of sclerosis. It has been observed that the families of animals so affected were subject in some instances to various nervous affections, such as spasms, which were generally of a choreic nature. Sclerosis may also follow as a sequel of some affections, such as certain fevers or inflammatory actions involving various parts of the nervous system.

Symptoms.—When the sclerosis involved the lobes of the cerebellum, it was noticed that the animal showed a tendency to execute gyratory movements, and had spasmodic contractions of the muscles of the eyeballs.

In all scleroses in the first instance, the motor power appeared to be more affected than the sensory.

Morbid Anatomy.—Pale greyish patches of varying extent may be found at the seat of disease. These changes have been observed especially on the lateral lobes of the cerebellum. In one case under our notice these changes were confined to the left lobe of the cerebellum; the cerebral hemispheres were healthy.

Sclerosis of the nerve-tissue is characterized by the growth of a large quantity of fibrous tissue, and by atrophy and degeneration of the nerve-elements themselves.

The tissue resembles such as is formed in productive inflammation, and sclerosis has in consequence been regarded as of inflammatory origin.

Some authorities, however, view the increase of connective-tissue as due to hyperplasia of the neuroglia, the cause being unknown (Green).

Treatment.—Nux vomica, or its alkaloid strychnine, with other vegetable tonics and iron, in conjunction with a good nutritious diet, are likely to prove beneficial, though complete recovery is perhaps only to be expected in very exceptional instances, where the nervous changes have not made any great progress.

CHOREA.

Definition.—Chorea is a peculiar disorder characterized by irregular clonic contractions of different muscles, especially those of the posterior extremities.

Nature and Etiology.—There is great doubt as to the true nature of chorea. As in man, it is of more frequent occurrence in the young, but though similar in many points in the equine species, it nevertheless cannot be regarded as strictly analogous with chorea in man.

Hereditary predisposition is perhaps the chief cause of chorea, though malhygienic conditions, overwork and exhaustion, may also act as exciting causes.*

In the horse, chorea is only exceptionally the sequel of other diseases, such, for example, as the specific fevers.

Several theories have been propounded from time to time to account for chorea.

By some it is regarded as a purely functional disorder, *i.e.*, unassociated with any organic change.

By others it is held to be due to some diseased condition of the blood, probably associated with rheumatism.

In some instances, at any rate, organic changes have been found after death.

Stringhalt, an involuntary convulsive action of the muscles of one or both hind-legs, occasionally affecting the fore-legs, may be regarded as a choreic affection.

Stringhalt probably depends upon some special lesion interfering with the functions of the nerves supplying the affected muscles, or of the spinal cord itself.

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* Mr. Williams, in his 'Principles of Veterinary Medicine,' says he has on record one instance where four young horses, the progeny of a dam which was affected in the back, died from spinal paralysis before they had attained the age of thirteen years. A fifth showed signs of aggravated nervo-muscular disturbance.

Sometimes, however, it is of a reflex character, being due to peripheral irritation, as, for example, when a bone spavin presses upon the bones of the hock (Williams).

In grey horses, however, it has been occasionally observed to be due to a deposit of melanotic matter in the sheath of the great crural nerves, and two cases are recorded in which it was due to exostosis of the ilium pressing on the sciatic nerve.

Symptoms.—The spasms occurring in chorea are sometimes very persistent, at other times they only occur at long intervals.

They present every degree of intensity, sometimes being very slight, sometimes very severe.

'*Shivering*' is a peculiar nervo-muscular disorder affecting the muscles of the back and posterior extremities.

When a horse the subject of this affection is backed or turned, the muscles of this region are thrown into clonic spasm, contracting and relaxing irregularly. The tail is often spasmodically elevated, and then depressed. When the horse is trotted forwards, the spasmodic contractions are very seldom developed, but they may be brought into action by the head being turned round rapidly.

In some instances the spasmodic contractions of the muscles of the loins and thighs come on while the animal is drinking. Though the posterior is more frequently affected than other parts, choreic disturbance may also affect the muscles of the neck and anterior extremities.

The spasmodic contractions in this region are very variable in severity and in the time of recurrence.

Morbid Anatomy.—Though in many instances nervous lesions have been found in connection with the brain and cord in chorea, yet no one in particular can be said to be specially characteristic of this affection.

In some instances tumours have been found in the ventricles. Melanotic disease was the cause of chorea in a case recorded by Professor Williams. In one instance before our notice, hyperæmia of the cord and of the basal ganglia of the brain was observed.

Effusion into the sub-arachnoid cavity of the brain and cord, with thickening of the serous covering of the brain, and various changes in the nerve texture, are also mentioned as having been met with.

Treatment.—In the first place it is necessary in all cases of chorea to remove the cause when that is possible.

The general hygienic conditions should be carefully attended to ; the diet should be good and nutritious, and the work proportionate to the strength of the animal.

Internally, mineral tonics, such as salts of iron, zinc, or Fowler's solution, with vegetable tonics, are worthy of trial.

EPILEPSY.

Definition.—Epilepsy is a peculiar affection of the nervous system, characterized by sudden temporary loss of consciousness, and associated for the most part with a convulsive attack which, in many instances, cannot be traced to any organic disease.

The fits are of variable severity and duration, and may be succeeded by debility, and sometimes by a drowsy or semi-comatose condition.

Pathology and Morbid Anatomy.—There are not many affections of the pathology of which we are so much in doubt as we are about that of epilepsy.

With regard to the causes of this affection we know but little definitely, but hereditary predisposition is very probably, as in chorea, an important factor in its production.

Epileptic attacks, being manifested under very different conditions of the system, cannot be regarded as a distinct and separate affection. Like jaundice, epilepsy is an accompaniment of several different diseased states.

In many cases after death no organic lesion is discoverable in epileptic animals, and the affection is in these instances regarded as functional.

It may depend upon disease of the brain, such, for example, as the deposition of morbid growths and inflammatory action, or other changes in the texture of the cerebral structure.

In some cases in man, epilepsy has been proved to be due to irritation of the brain caused by the projection of pieces of bone. This may also be a cause of this disease in the horse in some instances.

Finally, epilepsy may depend upon alterations in the blood-supply to the brain, and may be caused by reflex irritation from various distant organs in a state of disease.

The medulla oblongata and upper part of the cord are regarded by Dr. Reynolds as the primary seat of epilepsy. Some observers are of opinion that the parts primarily affected are the medulla oblongata, the corpora striata, and other parts of the base of the brain.

Brown Séquard has shown that epilepsy can be artificially produced in the guinea-pig by section of one of the lateral columns of the cord, anywhere between the medulla oblongata and the tenth dorsal vertebra. It must, however, be remembered that convulsion is by no means the most distinctive element in an epileptic attack. And, indeed, however seriously the cord and medulla and ganglia at the brain base may be affected subsequently in an attack, the earliest phenomena of an epileptic seizure must be connected with some limited spot in the nerve-centres, which, though different in different cases, is probably always the same for the same case (Bristowe).

In some instances of post-mortem examination in the horse, extensive disease of the membranes has been observed; but in many cases no abnormal lesions whatever were discoverable.

Symptoms.—In the human being an epileptic attack is not unfrequently preceded by what is termed the 'aura,' which is a subjective sensation of coldness, heat, tingling, etc. This, though of course not detectible in the horse, may likewise precede the epileptic seizure.

The horse, when attacked, staggers, champs his jaws, becomes unconscious, and falls to the ground convulsed.

Sometimes the spasms are very slight, and the animal quickly regains consciousness and seems as well as ever.

Sometimes the spasms are confined to one limb, sometimes to one side of the body, or to the muscles of a particular region, as the facial and cervical region.

In some instances the convulsions are very severe, and the breathing seems to be stayed for a time by the tense contraction of the respiratory muscles.

The animal froths at the mouth, grates its teeth, moves its head quickly to and fro, and tosses about wildly.

Opisthotonos, or bending of the trunk backwards, is sometimes produced by spasmodic contraction of the muscles.

The pulse is generally full and accelerated, though it may be weak and not much above the normal in frequency.

After a while, when the tonic spasms, succeeded by the clonic spasms, have abated, the animal regains consciousness.

Sometimes he remains dazed, as it were, semi-comatose; at other times he may manifest great weakness.

Treatment.—During the paroxysm cold water may be dashed upon the head, and all means should be adopted to prevent the horse harming himself in his convulsions.

In plethoric animals bleeding is recommended by some authorities.

After the attack is over the general health should be attended to, the diet carefully regulated, and the bowels opened.

If the disease depend upon peripheral irritation, as, for example, that which may be set up by worms, anthelmintics and purgatives should be administered.

In other cases a course of bromides may be administered. Bromide of ammonium, potassium and sodium, combined with a vegetable tonic, are perhaps the most efficacious of all remedies in subduing epileptic attacks when traceable to disease of the medulla and brain.

Belladonna is also of value in the treatment of epilepsy, and may be tried should the bromides fail.

Other remedies which have been recommended in epilepsy are zinc, silver, iron, and arsenic salts.

TETANUS OR LOCK-JAW.

Definition.—Tetanus is a diseased condition characterized by tonic spasms of the voluntary muscles, and to some extent, probably, of the involuntary muscles also.

The spasms are painful, and from time to time undergo exacerbation, followed by intervals of repose.

Etiology and General Pathology.—Of the domestic animals, the horse and sheep are the most liable to tetanus; but the disease is rarely seen in the ox tribe. We have seen several cases of tetanus in yearling beasts and also in calves. As is well known, this disease also occurs in human beings.

Tetanus frequently arises in connection with wounds, though it also occurs without any obvious cause whatever. When traceable to an injury, it is spoken of as traumatic tetanus; when it arises without apparent cause, it is called idiopathic tetanus.

The liability to traumatic tetanus is in no way dependent upon the severity of the injury, as this affection may follow even very slight wounds. It is most likely to follow lacerated wounds or punctures.

Wounds in the feet, thighs, quarters, and forearm are especially liable to be followed by tetanus; and this is more particularly the case when the nerves are injured.

Wounds, it will thus be seen, in parts which are the most tense, and in structures bound together by strong unyielding tissues, are more frequently succeeded by tetanus than injuries in the laxer tissues.

Injuries in the joints, although frequently inducing a high febrile condition, are nevertheless not often followed by tetanus.

The operations after which the disease most commonly supervenes are docking and castration; and, in some instances, the insertion of setons has been followed by an attack.

In some cases tetanus has been traceable to irritation of the stomach and intestines, caused by worms or collections of sand in the large intestines.

Uterine irritation following abortion is also a cause of tetanus in some instances.

Exposure to cold and damp, especially after exhaustion, may induce tetanus.

Horses, when exposed in cold weather after being clipped, are sometimes affected, and sheep similarly, when exposed in cold and boisterously wet weather immediately after being shorn, are said to be very liable to become affected with this disease.

Tetanus is more prevalent in certain districts than in others. In some parts of the country it is very frequently met with, while in others it is as rarely seen.

Sometimes it occurs as an enzoötic disease, and Mr. Williams records that in the summer of 1858 he witnessed 10 cases in a fortnight, of which some were traumatic, the others not being traceable to any injury.

In the human species tetanus is often idiopathic in hot countries.

Of the true nature of tetanus there is considerable doubt. Some hold that the traumatic variety is due to irritation of the nerves implicated in the wound, and that the muscular spasms result from reflex irritation.

In support of this it is argued that many cases of tetanus following docking have recovered after repeating the operation higher up. Yet it must be remembered that recovery by no means invariably follows the repetition of the operation, and, moreover, some cases of traumatic tetanus recover without any treatment whatever.

By some authorities tetanus is considered to be a blood disease, and several reasons have been advanced in support of this view, viz.,

(1.) Tetanus often occurs idiopathically without any injury.

(2.) It is more prevalent in certain districts than in others, and is sometimes enzoötic, affecting several animals in the same district. There is, however, no proof that tetanus is ever contagious.

(3.) The resemblance to hydrophobia and strychnine poisoning suggests a similarity in the nature of the cause.

(4.) Tetanus is said to be transmissible to men by eating the flesh of animals which have died of this disease. Of the truth of this the herdsmen of the districts on the River Plate are confident; yet, nevertheless, confirmatory evidence seems to be lacking. Mr. Robertson records that he has known of dogs fed on horses which had died of tetanus, and does not recollect any evil results ensuing in consequence.

Other reasons have also been given in support of the view that tetanus is a blood disease.

The assertion that the spasms begin in muscles which have no anatomical connection with the injured nerves cannot be regarded as of any weight whatever in deciding in favour of the affection being a blood disease.

In what manner is the blood then altered?

Are we to look to changes in its quality, or to the presence in it of some endopathic poison resembling strychnine in its effects, as suggested by Sir T. Watson and Dr. Richardson? Or are we to look for the presence of living microbes in the blood.

This question for the present remains unsettled, but it seems not improbable that tetanus may eventually prove to be due to the presence and development of living germs in the blood and tissues.

We may, perhaps, the more easily understand tetanus as a disease if we first consider cursorily some of the phenomena exhibited by a tetanized muscle.

If a nerve-muscle preparation be carefully made and preserved, and the nerve be irritated in any way whatever, the muscle will respond to the application of this new incident force by an aggregate of changes which are collectively spoken of as a contraction.

Further, if during the period of maximum intensity of the contraction another equal stimulus be applied, the additional response will be nearly equal to the first.

A lever suitably attached to the muscle will be raised very nearly as much again, the amount of the two contractions will be nearly twice that of the first alone. If more stimuli of equal intensity be successively applied, with each subsequent irritation, the amount of the consequent contraction becomes gradually less, until at length, when the stimuli reach a certain number in a given time, the lever is not raised higher, but the component contractions are apparently united, fused, as it were, to form a single continuous uniform contraction, and though really still existing, are not to be indicated by ordinary instruments.

This condition of a muscle, which is called tetanus, may be produced by the interrupted current, or by any rapidly repeated shocks. The frequency of the stimuli needed to produce tetanus differs in different cases.

'Kronecker and Stirling find that ten stimuli per second will cause complete tetanus in the red muscles of the rabbit, whereas the pale muscles require at least double that number.

'When the stimuli are repeated more frequently than is required to bring about a complete tetanus, the constituent contractions are still proportionately increased in frequency. This is shown by the increased pitch of the muscular sound.

'Kronecker and Stirling, by using a special instrument for rapid interruption, the so-called tone inductorium, have been able to obtain in all cases a complete tetanus with alternating induction shocks, even when repeated, they believe, as frequently as 22,000 times a second' (Foster).

Thus it appears that the number of constituent contractions which may coalesce to form a tetanus is very great indeed, and we can only conclude from this that in the disease where so many muscles are involved the expenditure of force entailed is enormous, even if we suppose that the spasms are not of a very complex character, that is, are not constituted by a large number of component contractions.

Every time a muscle contracts there is manifestly an expenditure of energy. Work is done; force is supplied, directly or indirectly, by means of the dissociation of highly complex organic compounds, of whose nature little is known, and thus waste products are produced.—*From an article in the* VETERINARIAN (*Oct.* 1882), *by Mr. J. B. Gresswell.*

Varieties and Symptoms.—There are several varieties of tetanus, which have received various names from the particular muscles mainly involved.

As a general term tetanus comprises all the varieties, and involves a greater or less number of the voluntary muscles, and probably also some sets of involuntary muscles.

When the muscles of mastication are alone or in chief part affected, the condition is called trismus, or lock-jaw. This is noticeable as being in most cases of tetanus a prelude to the succeeding symptoms.

When the superior cervical and dorsal muscles are especially affected, producing elevation of the head, and curving downwards of the spine, the affection is called opisthotonos.

When the muscles of one side are affected, the condition is called pleurosthotonos, or tetanus lateralis.

When the inferior muscles are involved, the chin drawn towards the heart, and the spine arched backwards, the condition is spoken of as emprosthotonos.

This latter condition is very rarely met with in horses, but has been observed on one occasion at any rate, being produced by rigid contraction of the inferior muscles.

Generally, however, in the horse trismus with opisthotonos is the condition met with; pleurosthotonos is sometimes, though not frequently, observed.

Tetanus may be acute, sub-acute, or chronic.

When this affection owes its origin to a wound, it usually manifests itself in from ten to twenty-eight days after the infliction of the injury.

Generally there is first noticed a stiffness about the neck and lower jaw, and of the muscles near the seat of injury, and there is difficulty in mastication and deglutition, together with increase of the secretion of saliva, and a peculiar champing of the teeth.

If the head be suddenly elevated, or the horse suddenly disturbed, there is a characteristic protrusion of the membrana nictitans over the eyes, which are withdrawn within the orbits, thus causing the animal to show the white conjunctival surface at every convulsive retraction.

As the disease advances, the stiffness becomes more marked, especially in the muscles of mastication and in those of the upper part of the neck, and soon spreads to other groups of voluntary muscles, especially those of the abdomen, back, and hind-quarters.

At length the tetanic condition becomes fully established, and is very apparent even to a superficial observer.

The limbs are extended, and kept apart; the tail is elevated, and the animal moves in a peculiar, stiff, straddling, way, with difficulty and pain.

The pulse is generally not much affected in the first instance, but in a day or two it becomes accelerated, and the artery becomes firm, hard, and incompressible. In very acute cases, however, the pulse may become much accelerated in the very early stages.

The temperature rises considerably in some very severe cases; generally, however, it is not markedly high.

The bowels are usually constipated, and the bladder becomes contracted.

During the course of the disease there are periods of calm alternating with violent paroxysms.

These latter are easily induced by any sudden disturbance of the patient by loud noises, or by sudden flashes of light into the darkened box. Quietude tends to subdue the paroxysms in a corresponding degree.

During their continuance the breathing becomes more accelerated and difficult, and the surface of the body is bedewed with perspiration; the nostrils are dilated, and the nose protruded.

Course and Prognosis.—The duration of tetanus varies very markedly. Some of the most severe cases have been known to run their entire course in less than forty-eight hours.

In other instances, the animal may live two or three weeks, and then succumb at the end of that period.

As a rule, tetanus runs a more rapid course in thoroughbred horses than in animals of coarser breed, and appears to be of a more active type in excitable horses than in animals less sensitive to external agencies.

In the horse it usually assumes an acute or sub-acute form.

When the disease does not prove fatal, the tetanic condition declines slowly, lasting from three to five weeks or so.*

In some very severe cases the breath becomes fœtid before death, and if the mouth be examined, a quantity of slate-coloured epithelium is found on the inner surfaces of the lips, gums, and tongue (Williams).

Morbid Anatomy.—In some instances the spinal cord is found to be congested in varying extent and position, and microscopic examination in some instances reveals pathological lesions, which, though perhaps not characteristic, are nevertheless very marked.

The right side of the heart is sometimes found engorged with blood, and the lungs and other organs sometimes congested.

In some instances, one or more of the muscles may be found ruptured from the violence of the muscular spasm.

Microscopic Appearances of the Nerve-structure.—The perineurium around the nerves proceeding from the seat of injury is sometimes thickened. In a case in which after death a piece of straw was found imbedded in the metatarsal nerve, the latter was found highly congested by Mr. D. Gresswell for some distance from the actual seat of injury.

In the epineurium surrounding the nerve-bundles no special change was noted, but each bundle contained an amount of granular material which stained deeply, and was very probably the result of inflammatory action.

The ultimate nerve-fibrils were altered, and the medullary sheaths of Schwann were shrunken, while the axis cylinders appeared as though split into several segments.

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* In a case quite recently under our notice, the muscles of the near side of the neck of a young pony continued in a state of contraction for upwards of four months, and after that time gradually relaxed. During the latter three months the animal was perfectly well in every other respect.

In no instance have we been able to detect any special change in the sympathetic nerves or ganglia.

Sometimes the spinal cord is much altered in certain parts. In one instance, following on very severe injury of the posterior extremity, patches of altered tissue were found in both lateral columns, and in the posterior grey horns of the spinal cord in the lumbar and dorsal regions.

These were less numerous in the cervical region, and stained deeply with hæmatoxylin. They were visible to the naked eye as rounded oblong patches.

The cord and its membranes were congested in parts.

Treatment.—The animal should be placed in a large well-bedded and well-ventilated loose box, which should be kept dark.

Strict quietude should in all cases be enjoined, and is of the utmost importance in the treatment of this affection.

Among the many drugs which have been tried for the cure of this disease, no one in particular can be looked upon in the light of a specific.

A moderate dose of some purgative should be administered in the first place, and the bowels afterwards kept open by a laxative diet of mashes and oatmeal gruel.

The wound, if there be any, should be carefully examined, and all irritating matter washed away.

In cases of tetanus following docking, the operation is repeated by some, but is condemned by other authorities. The late Mr. D. Gresswell advocated the repetition of the operation in such cases.

We strongly recommend that the tail should be re-docked at the next joint, and the actual cautery should be well and thoroughly applied. Nearly every animal we have seen in which the tail has been redocked has recovered by the help of careful treatment.

Of the many remedies recommended for the treatment of tetanus may be mentioned—belladonna, hydrocyanic acid, nicotine, aconite, chloroform, chloral hydrate, bromides of sodium and potassium, morphia, Calabar bean, salicine, and alkalies.

Of the Calabar bean and its alkaloid, physostigmina, we cannot speak favourably.

On the whole we have had most success with *nicotine, chloroform, tincture of aconite, caustic potash and morphia.*

Chloral hydrate has also proved of value in many cases.

Belladonna may be given in the form of extract or tincture. If the extract be selected, about one drachm or more may be given three times daily. It may be administered by smearing it over the tongue or by placing it among the back teeth.

Tincture of aconite or morphia are very useful in allaying severe paroxysms, as also is chloroform.

If hydrocyanic acid and bromide of potassium be given, they may be added to the drinking water. Of the hydrocyanic acid, ʒi. may be given three times daily with ʒii.—ʒiv. of potassium bromide.

With regard to the question of slinging, authorities are not of one opinion. We are disposed to advocate slinging in the early stages, in the case of heavy draught horses used for agricultural or other purposes. We think that slinging should be resorted to in every case of tetanus.

In the case of thoroughbred or very nervous excitable horses, the advisability of slinging is questionable. Considering, however, that horses already recovering sometimes fall when the muscles begin to relax, and, struggling violently, bring on the spasmodic contraction more severely, some advise slinging loosely, at any rate, but not so as to irritate or annoy the animal.

Locally, liniment of belladonna and camphor may be applied along the spine. Irritating liniments and mustard are recommended by some, but probably they do as much harm as good. Other authorities recommend the application of ice-bags. Two yearling thoroughbreds recovered under the influence of monobromide of camphor, given in two-drachm doses thrice daily.

The following remarks on tetanus, by ourselves, are taken from articles which appeared in the *Veterinary Journal* for 1885, vol. xx., pages 73, 158, and 323:

'In bringing before the notice of the readers of the *Veterinary Journal* the subject of the special treatment of tetanus in horses, it is intended, firstly, to briefly review the physiological action of the remedies which have been advocated by various eminent authorities; secondly, to indicate the effect which has attended the use of each in our hands; and, lastly, to suggest a method of treatment which some others may possibly think well to adopt.

'The most important of the drugs from time to time advocated in the treatment of tetanus in man and animals are the following, alphabetically arranged: Aconite, amyl nitrite, belladonna and its alkaloid, atropine; bromides of ammonium, potassium, and sodium; Calabar bean and its alkaloid, physostigmine; cannabis Indica, chloral hydrate, chloroform, conia, curare, gelsemium, hydrocyanic acid, opium and its alkaloid, morphia; potash (bicarbonate and hydrate of), quinine, salicine, tobacco and its alkaloid, nicotine.

'All of the above remedies have been tried in our treatment of tetanus in the horse, with the exception of curare, or urari, the efficacy of which we ourselves have no experience of.

'We shall, therefore, not allude to this drug again; but may mention that cases of tetanus in man have been treated by the hypodermic injection of the "South American Indian arrow-poison," and that this remedy has been used in the treatment of chorea and hydrophobia in man, as well as in physiological experiments on animals, in order to paralyze muscular movements.

‘ACONITE.

‘*Physiological Action.*—Aconite, when given internally, always reduces the strength of the pulse, and thus retards the circulation. When administered in moderate doses, this powerful depressant reduces the number of the beats of the heart, and renders the breathing slower, while, when large or poisonous doses are taken, the pulse is accelerated, and the breathing becomes sharp and hurried. Physiological observers have shown that aconite paralyzes the heart of pigs, arresting its action in systole.

‘After death from aconite, the heart fails to respond to galvanic stimulation; and it is, therefore, believed that this poison affects the cardiac muscle itself.

‘According to the experiments of Ringer and Murrell, aconite paralyzes all nitrogenous tissues, and affects all the structures of the heart—viz., in the first place its ganglia, next the nerves, and, finally, the muscular substance. Regarding the action on the nervous system, Boehm concludes that aconitia first paralyzes the sensory, and then the motor, part of the cord; while Liegois and Hottot believe that it first paralyzes the perceptive centres above the spinal cord, and afterwards the terminations, and, lastly, the trunks of the sensory nerves.

‘The latter observers record that frogs poisoned with aconite lose sensation, whilst voluntary and reflex action remain; and reflex action itself ceases whilst the animal still retains voluntary power.

‘On administering strychnia, these observers produced tetanus, the paroxysms of which could be excited by irritating any part of the body. They, therefore, conclude that at this stage the sensory nerves are not affected, and that anæsthesia depends on the influence of the aconite on the sensory perceptive centres.

'After a time, however, irritation of the afferent nerves fails to excite a tetanic paroxysm; wherefrom they conclude that aconite next paralyzes the terminations, and then the trunks of the sensory nerves. According to Ringer, aconite is a protoplasmic poison, and destroys the functions of all the nitrogenous tissues—first, of the central nervous system, next of the nerves, and, last, of the muscles; but it has an especial affinity for the sensory apparatus, paralyzing first the sensory perceptive centres.

'Aconite, like tartar emetic and *potash salts*, is a powerful depressant; and Ringer suggests that these drugs do not merely depress through their paralyzing effect on the heart, but that they depress also by their poisonous action on the central nervous system and on the motor nerves and muscles.

'*Value of the Preparations of Aconite in Tetanus.*—In the treatment of severe cases of traumatic tetanus, we have found few drugs of more benefit than aconite. It is our practice, in cases of acute tetanus following the infliction of an injury, to administer hypodermic injections of about ten minims of Fleming's tincture. The efficacy of this method of treatment is more marked in plethoric animals, and when the febrile symptoms manifested are of a severe character. But ordinary cases of idiopathic tetanus do not seem to derive much benefit from aconite; in such cases, as well as in those forms of traumatic tetanus supervening after the lapse of a long interval from the infliction of the injury, we prefer the hypodermic injection of morphia. The use of aconite in the treatment of tetanus in the horse requires care and judgment.

‘AMYL NITRITE.

‘*Physiological Action.*—When the vapour of amyl nitrite is inhaled, there is caused a large and rapid fall of the blood pressure, and the heart's action becomes accelerated. This fall of the blood pressure is due mainly to the great dilatation of the arterioles, and, after large doses, to depression of the heart. If the inhalation be stopped, the arterial blood pressure rapidly returns to the normal.

‘The dilatation of the arterioles is believed by some to be due to the direct action of the drug upon them, and not to any influence exerted on the vaso-motor centres. Dr. Brunton believes that the nitrite partially paralyzes the sympathetic ganglia and their motor nerves. Nitrite of amyl does not affect the motor or sensory nerves until just before death.

‘Dr. H. Wood has shown that loss of reflex action and of voluntary power occurring after large doses is due to the depressing action of the drug on the motor tracts of the cord, and, to a slight extent, on the motor nerves and on the muscles.

‘On the sensory tracts of the cord it seemingly has no effect, nor has it any on its co-ordinating centres.

‘It abolishes reflex action, but whether it depresses the reflex function of the cord is uncertain, as it may simply act on the motor part of the cord.

‘*Value of Nitrite of Amyl in Tetanus.*—We are not aware whether this remedy has been much used by others in the treatment of tetanus in the horse, but we believe that but few cases have been treated by it.

‘In man this remedy has been used in tetanus to allay the spasmodic attacks; and though we have not a large experience of its value in equine practice, we believe that its action for this purpose is not so efficient or beneficial as is the inhalation of chloroform : yet, nevertheless, it does seem to have a beneficial action ; but that relaxation of the jaws to be obtained by inhalation of chloroform did not follow in the instances in which we gave the nitrite a trial.

‘BELLADONNA AND ATROPINE.

‘*Physiological Action.*—If a small dose of atropine be injected into the jugular vein of a dog, the cardiac and respiratory movements will be quickened, and the arterial blood pressure will be raised.

‘The quickening of the heart’s action is due to the paralyzing of the cardiac inhibitory filaments of the vagi ; the acceleration of the respiration is due to stimulation of the respiratory centre in the medulla ; while the raising of the blood pressure is due to contraction of the systemic arterioles, probably through the medium of the sympathetic.

‘Atropine has both a paralyzing and a stimulant action on the spinal cord ; but the former effect is greater than the latter.

‘In order to show the spinal stimulant action of atropine, animals whose respiratory muscles may be paralyzed without causing death have been experimented upon. In the frog, a dose below the fatal minimum paralyzes, firstly, the cutaneous sensory nerves, next the motor nerves and spinal cord ; it does not impair idio-muscular contractility.

‘After the lapse of a variable number of hours or days, tetanic symptoms, not unlike those of strychnia poisoning, are produced ; these are due to the excitant action of the alkaloid on the spinal cord. This effect of atropine on the spinal cord was pointed out by Dr. Fraser, who has shown (1) that in frogs tetanic symptoms follow the subcutaneous injection of a dose of sulphate of atropine equivalent to about 1,000th of the weight of the animal ; (2) that this tetanus sometimes sets in on the second day, but more frequently on the third, fourth, or fifth; (3) that it varies in its duration from a few hours to seventeen days; (4) that it is due to the action of the drug on the cord (medulla oblongata and medulla spinalis). The afferent or sensory nerves are unaffected, or but little affected, by atropia. The accelerator nerve of the heart is probably stimulated by it.

'Ringer thus summarizes the probable effects of atropine:

'(1.) It tetanizes the cord, and heightens its reflex function.

'(2.) It stimulates the respiratory centre and the inhibitory centre of the heart.

'(3.) It stimulates the cardiac accelerator nerve or its centre.

'(4.) It stimulates the vaso-motor centre, and so heightens arterial pressure.

'(5.) It paralyzes the motor nerves, first affecting the trunks.

'(6) It paralyzes the terminations of the vagi, both in the heart and lungs.

'(7.) It paralyzes the terminations of the secretory nerves of the salivary glands, and perhaps those of the sweat glands.

'(8.) It paralyzes the terminations of the inhibitory fibres of the splanchnics.

'(9.) Large doses slightly depress the functions of the afferent nerves.

'(10.) It paralyzes the terminations of the oculo-motor nerves, and stimulates the sympathetic, so far as the iris itself is concerned.

'It appears, therefore, that whilst it acts as a stimulant to a large part of the central nervous system, to many of the nerves it operates as a paralyzer.

'*Value of Belladonna and Atropine in Tetanus.*—Belladonna and its alkaloid, atropine, have been extensively used for the treatment of tetanus. The late Mr. D. Gresswell used it for some time, but renounced it entirely after a good trial, believing it to be of little value. We have also arrived at the same conclusion, and never use it now in the treatment of this disease in the horse.

'In the *Veterinary Journal*, March, 1884, Mr. Davis records that he administered one-grain doses of sulphate of atropine every three hours, but without effect on the spasms. From the above physiological review of the action of this drug, it seems, moreover, unlikely that we could expect that it would prove very beneficial in tetanus.

'Mr. Charles Gresswell, of Nottingham, also is of one opinion with us regarding the use of belladonna in tetanus.

'BROMIDES OF AMMONIUM, POTASSIUM, AND SODIUM.

'*Physiological Action.*—We need say little of the physiological action of the bromides, as their use in disease depends more upon the accumulation of clinical evidence of their value than upon physiological experimentation, which has yielded somewhat contradictory results.

'The bromides, according to Brown-Séquard, contract all the blood-vessels, producing anæmia of the brain and spinal cord, thus diminishing the excitability of these organs. Bromide of potassium induces in animals a decided diminution of reflex irritability and of cutaneous sensibility; and experiments render it probable that this diminished reflex irritability is due in part to the effects of the drug on the reflex function of the cord, and in part to its effect on the sensory nerves.

'*Value of the Bromides in Tetanus.*—The bromides have been extensively given in the treatment of tetanus, and are of undoubted efficacy in diminishing the severity and duration of the paroxysms. These remedies, however, cannot be relied upon in the treatment of tetanus, but they may be administered along with other medicines of greater potency.

'We do not often use the bromides now, unless the case be of an unusually mild type, as their efficiency, never very great, cannot be relied on in severe cases.

'The bromides used by us were the salts of potassium and ammonium.

'CALABAR BEAN AND PHYSOSTIGMINE.

'*Physiological Action* (abstracted from Dr. Fraser's investigations).—An animal, when under the influence of a small but fatal dose, speedily manifests a slight tremulousness, which increases until the whole frame becomes limp and flaccid; then general paralysis follows, the bowels and bladder are emptied involuntarily, and the pupils generally contract.

'At this stage all reflex action of the cord is destroyed, and if the animal is anywhere irritated, the contractions respond to the call. Respiration becomes gradually slower and slower, and at last ceases. Immediately after death the pupils dilate, and the muscles appear to be unaffected; they contract when cut, and respond to the irritation of their nerves.

'The paralysis of the muscles has been shown by Dr. Fraser to be due to changes effected on the *spinal cord itself by the poison.* He found that he could excite no muscular contractions by galvanizing any part of the cord of an animal poisoned by the bean; while the motor nerves still retained their functions, and easily transmitted impressions to the muscles, which, on their part, freely responded to very slight stimulation of their proper nerves.

'The reflex functions of the cord were destroyed long before the nerves lost their conducting power. After the loss of reflex power in animals poisoned by Calabar bean, pretty active muscular contractions could be excited by mild galvanic stimulations of the motor nerves.

'Dr. Fraser recommends, from his physiological researches, Calabar bean as an antidote to strychnine; and he points out its superiority to curare, which paralyzes only the motor nerves, while the former paralyzes first the cord, and then, after some time, the motor nerves.

'Physostigmine raises the blood pressure, and is also a respiratory poison, and, indeed, generally kills by paralyzing the respiration.

'*Value of the Calabar Bean and its Alkaloid in Tetanus.*—Reasoning from the facts above mentioned, we should expect that Calabar bean would prove a most valuable medicament in tetanus. Some cases in man have been treated by physostigmine, and have terminated successfully, but in equine medicine this powerful spinal sedative has had a far larger and more extensive trial.

'It would be interesting if statistics as to the result in each case could be collected, as opinions as to its value are not unanimous.

'Our experience of the drug is more limited than in the case of other remedies; but, judging from what we have seen of its value, we do not think so favourably of its action as to warrant us in relying on its efficacy.

'CANNABIS INDICA.

'*Physiological Action and Value in Tetanus.*—Of the physiological action of cannabis Indica much still remains to be learnt.

'In its anodyne and soporific action it resembles opium. It has been chiefly employed in medicine for its antispasmodic and anodyne powers, and has been administered in man and in the horse for the treatment of tetanus. In our experience cannabis Indica is not of great value in tetanus in horses, and we, therefore, do not advocate its use.

'Hydrate of Chloral

'*Physiological Action.*—When administered in medium doses, chloral hydrate causes sleep. This is said to be partly owing to its direct action on the nervous structure of the brain, and partly to the anæmia which shortly succeeds the temporary congestion induced in this organ.

'Our own investigations lead us to attribute the soporific effects of chloral more especially to the former of the two above causes, and rather, also, to congestion of the central organ of the nervous system than to anæmia. For in cases where small animals have been killed after several rather large doses of chloral, the cerebral structures appeared rather congested than anæmic.

'Large doses of chloral induce profound sleep, which passes into coma. The number of the pulse-beats are reduced by this drug, or they are rendered very weak and rapid, and the temperature of the animal falls.

'At first the pupils contract, and afterwards dilate; it is, however, not always possible to detect any contraction when the drug is administered in medicinal doses.

'Chloral hydrate induces great muscular relaxation, and after poisonous doses the animal dies from arrest of respiration or paralysis of the heart. Some physiologists maintain that chloral produces hyperæsthesia, but this is denied by others. In large doses, at any rate, anæsthesia is caused. The paralysis and loss of reflex action seem to be due *to the direct action of the agent upon the cord itself,* for the motor nerves and muscles themselves are not affected by it. Moreover, in a chloralized animal direct irritation of the spinal cord produces less active contraction than in animals not under the influence of chloral.

'The blood pressure is markedly lowered by large doses of chloral; the heart is weakened, and in poisonous doses is arrested in diastole.

'The frequency of the breathing is diminished, owing to the action of the drug on the respiratory centre in the medulla oblongata.

'*Value of Chloral in Tetanus.*—On purely physiological grounds we should expect that chloral would prove an invaluable remedy in tetanus, and, practically, it has been found to be of undoubted efficacy in reducing the number and the severity of the spasmodic seizures of tetanus.

'Mr. D. Gresswell administered this drug for many years in the treatment of this disease, and believed it to be a very valuable remedy. And though chloral does not, in our opinion, exert so powerful an influence in the progress of tetanus as do aconite, morphia, or tobacco (given in the form of enemata, or hypodermically as nicotia or nicotine), yet, nevertheless, it has proved in our practice, and in that of Mr. Charles Gresswell, of Nottingham, a very efficient adjunct to the more powerful medicines.

'Many eminent authorities, both at home and abroad also, have spoken in high terms of the efficacy of chloral in this painful disease, yet it should be remembered that in some, at any rate, of the recorded cases, other remedies, such as morphia, hydrocyanic acid, and tobacco were also administered.

'CHLOROFORM.

'*Physiological Action.*—The action of chloroform as an anæsthetic is too well known to need lengthened comment here.

‘Full doses of chloroform, inhaled or ingested, paralyze and narcotize the cerebro-spinal nervous system. They first briefly excite the brain and the other nervous centres, and then paralyze and inhibit their various functions. The heart’s action is at first accelerated, and afterwards steadily depressed, and the pulse becomes weak and soft.

‘The respirations, at first diminished, become more rapid, but as the narcosis increases they again become retarded, and shallow and irregular also.

‘*Value of Chloroform in Tetanus.*—In tetanus chloroform has been administered by the mouth, and also as an inhalation. We have not much experience of its efficacy when given by the mouth in this disease, but in several cases have tested its value when inhaled. If the horse be allowed to breathe over a bucket half full of hot water, to which fl. ʒ iii. to fl. ℥ ss. of chloroform has been added, he becomes quieter in some cases, the spasms become less severe, *and the muscles of the jaw relax.* But the advantage obtained, though, we believe, more lasting than in the case of inhalation of nitrite of amyl, is not permanent. To be of any material advantage, chloroform inhalations require to be repeated once daily, and in severe cases twice.

‘Conium and Conia.

‘*Physiological Action.*—The experiments and observations of Paul Guttmann on rabbits show that conium causes gradual paralysis of the voluntary muscles, and then of the muscles of respiration. The paralysis first begins in the hind extremities, then affects the anterior muscles and those of the trunk, and lastly those of respiration.

‘This paralysis is not due to the action of the drug upon the muscles themselves, for it has been shown that the irritability of muscles through which blood poisoned with conia has been permitted to flow is as great as that of muscles of the same animal protected from the action of the poisoned blood by ligation of the blood-vessels.

‘Nor does conium paralyze by its effect on the cord itself, for if a limb be protected from the influence of the poisoned blood by ligation of both its artery and vein, and the animal (frog) is then poisoned and thoroughly paralyzed by conium, the ligatured limb can still manifest powerful movements.

‘Now, we see that the only muscles which in this experiment retained their power of movement were those which were protected from the poisoned blood by ligature of the blood-vessels. Conium, therefore, acts upon some of the tissues protected from the action of the poison, and these tissues have been proved not to be the muscles. It follows, therefore, that they are the nerves themselves. Guttmann has shown that the poison affects the periphery of the motor nerves earlier than the trunk.

‘Finally, the sensory nerves are apparently not affected. Thus conia paralyzes solely by its action on the motor nerves.

‘Dr. Harley’s investigations lead him to the conclusion that conium is a depressant of the motor tract of the cord and the motor ganglia of the brain. There is much difference of opinion as to its action on the heart.

‘*Value of Conium in Tetanus.*—In the treatment of tetanus in horses, conium has yielded only disappointing results in our hands and in those of many other veterinarians. When given in full doses, the hypodermic injection of conia appears to have some, but not much, effect (and that not permanent).

‘Guttmann found that conium, even in very large doses, failed to arrest the tetanic spasms in strychnine poisoning.

‘From our own investigations into the pathology of tetanus, it appears that in some cases of traumatic tetanus, at any rate, pathological lesions do take place in the cord itself; we could perhaps, therefore, hardly expect permanent advantage from the employment of an agent the chief action of which is on *the endings of the motor nerves.* We should rather expect permanent advantage from an agent, such as chloral hydrate, acting on the central nervous system. At the same time the pathology of tetanus is still enshrouded in doubt.

'But whether we regard the disease as a blood disease, or whether we hold with some that the traumatic form is due to irritation of the nerves implicated in the wound, and regard the muscular spasms as the result of reflex irritation, yet we should in either case expect more advantage from those sedatives which act on the central nerve organs rather than from those, such as conium and its alkaloid, acting on the motor nerve-endings.

'The following are the reasons which have been advanced in support of the view that tetanus is a blood disease:

'1. It often occurs idiopathically without any injury.

'2. It is more prevalent in certain districts than in others, and is sometimes enzoötic, affecting several animals in the same district. There is, however, no proof that tetanus is ever contagious.

'3. The resemblance to hydrophobia and strychnine poisoning suggests a similarity in the nature of the cause.

'4. Tetanus is said to be transmissible to men by eating the flesh of animals which have died of the disease. Nevertheless this statement requires confirmation.

'GELSEMIUM SEMPERVIRENS, S. GELSEMIUM.

'*Physiological Action.*—The root of "yellow jasmine," imported from the United States, and its alkaloid gelsemia, or gelsemine, are powerful paralyzers and respiratory poisons. Ringer says the paralyzing action of the drug is best studied in frogs. In these creatures it often causes tetanus as well as paralysis. With small doses of the alkaloid paralysis only is produced ; with larger doses quiverings and tetanoid movements, and only after large doses decided tetanus. The spinal cord is paralyzed, but the motor nerves and muscles are unaffected. The tetanus is due to the action of the poison on the cord, and paralysis always precedes it. In the property which gelsemine has of first weakening and then tetanizing the cord, it resembles jaborandi and its alkaloid pilocarpin, buxus sempervirens, and other drugs.

'Gelsemium is a powerful respiratory poison, and generally, if not always, destroys warm-blooded animals by asphyxia, before it produces complete paralysis (Ringer).

'Gelsemium is said to have febrifuge properties, as it lowers the pulse and depresses the nervous system. It has been much used to relieve human beings affected with acute and rheumatic neuralgia and toothache. It is an antidote to strychnine poisoning.

'*Value of Gelsemium in Tetanus.*—Gelsemium has been given successfully in a case of traumatic tetanus in man. It has not been much used as yet in this country in veterinary practice. Our experience of its efficacy in tetanus is limited to one case, in which the tincture was administered thrice daily.

'Although the case, which was one of the traumatic variety of a not very severe type, recovered, yet we cannot attribute the success to the gelsemium, as other remedies were also given.

'As yet, therefore, we cannot speak definitely regarding its value in tetanus, though we are not inclined, from our limited experience of it, to have much hope in its efficacy.

'In the writers' "Veterinary Pharmacology and Therapeutics," we have mentioned the doses of the drug employed, and other facts of importance concerning its therapeutic value and preparations, etc. We are not aware whether others have employed gelsemium for the treatment of tetanus, but if so, we should be glad to hear of the results.

‘HYDROCYANIC ACID.

‘*Physiological Action.*—Hydrocyanic or prussic acid, is alike fatal to animal and vegetable life. In toxic doses it paralyzes the cerebro-spinal axis, acting especially on the medulla oblongata and its respiratory centre. Death may be caused in two ways by this potent poison.

‘A large dose proves fatal in the course of a few seconds. The animal falls as if struck by lightning, and the pupils are widely dilated. The heart and the nerve centres seem to have their functions arrested simultaneously.

‘A smaller but fatal dose causes death by paralysis of respiration. The breathing becomes slow and gasping, the heart's action and pulse almost imperceptible, and consciousness is lost. In many cases death is preceded by suffocative convulsions. The dyspnœa is due to two causes, viz., to the paralysis of the respiratory centre in the medulla oblongata, and also to the fact that prussic acid combines with the hæmoglobin of the red corpuscles, thus, probably, interfering with the giving-up of oxygen to the tissues.

‘The toxic effects of prussic acid are observed in all animals, by whatever way the poison enters the system.

‘*Value of Prussic Acid in Tetanus.*—We believe that we are correct in stating that hydrocyanic acid has had a more extensive trial in the treatment of tetanus than almost any other remedy; yet there is as much diversity of opinion as to its efficacy in this disease as there is about the precise mode of its physiological action.

'Mr. D. Gresswell prescribed this acid in a large number of cases, and was of opinion that, although a useful remedy, it could not be relied upon in any doses in severe cases. Our own experience also, and that of Mr. Charles Gresswell, does not lead us to regard it as of the same efficacy as aconite, tobacco, morphia, or chloral hydrate.

'Finlay Dun, in his "Veterinary Medicines," says: "Mild cases of tetanus, especially in young animals, are sometimes benefited; but it is of little use in aggravated cases or in aged animals."

'Professor Williams, in his "Veterinary Surgery," says: "The prussic acid treatment, so highly recommended by Mr. Lawson, of Manchester, has with me proved to have no special superiority,"

'Viewing the question from an etiological and physiological point of view, one would not have great faith in the value of prussic acid in the treatment of this disease. At the same time, it is of undoubted power in reducing the severity of the spasms of tetanus; but the administration must be repeated pretty frequently, as its soothing effects, though probably not nearly so transient as those of physostigmine, do not last very long. Of the value of the cyanides in tetanus, we have no experience.

'OPIUM, AND HYDROCHLORATE AND ACETATE OF MORPHIA.

'*Physiological and Therapeutic Action.*—We do not purpose to enter fully into the physiological and therapeutical properties of opium and the salts of morphia, as these are so well known to all; yet a few words may, perhaps, recall to the memory some of the more important facts of the actions of these much-used and valuable remedies, bearing more especially on the disease in question. It will be best to treat of opium and its alkaloids together, as the latter have the same properties as opium in a concentrated form, being, however, less exciting and stimulating, and also less diaphoretic and constipating. Opium acts on the cerebro-spinal and on the sympathetic systems, and when given in full doses causes stimulation, followed by depression.

'The following conclusions and experiments are derived from Dr. Harley's investigations. The soporific effects of opium result from the action on the cerebral hemispheres, and the excitant from excessive stimulation of the corpora striata and spinal cord. The acceleration of the heart is viewed as partly due to direct stimulation of the sympathetic nerves, and partly due to an indirect stimulation of the same centres, resulting from the excitement of the muscular movement.

'Dr. Fothergill ascribes the soporific effects of opium to the anæmia of the brain and diminished activity of the cerebral cells, said to be caused by opium and its alkaloid, morphine.

'Poisonous doses of opium cause death, by cessation of the respiratory movements. In a case where one ounce of powdered opium, dissolved in water, was given to a strong, healthy cart-horse, the pulse fell from forty-four to thirty-four beats per minute, the superficial muscles were relaxed, the nasal mucous membrane blanched, and the animal was dull and dejected.

'After half an hour, four drachms, also dissolved in water, were given, and the dulness and the weakness of the pulse, which had now fallen to thirty-two, was increased.

'Half an hour later the animal, continuing in the same condition, was destroyed.

'In animals poisoned by opium, the ventricles of the brain and the sub-arachnoid spaces contain more fluid serum than is normally present. There is general venous engorgement, and the right side of the heart is distended by soft coagula.

'*Value of Opium and of the Salts of Morphia in Tetanus.*—As with so many of the remedies mentioned, there is great diversity of opinion regarding the beneficial action of opium and morphia in tetanus. Finlay Dun writes: "Tetanus, occuring in young animals from exposure to cold, is often treated successfully by opium, especially when conjoined with chloral hydrate or conium; whilst, in the more serious cases amongst adults, spasms and morbidly acute sensibility have been removed for several hours by the hypodermic injection of morphine deeply inserted into the tetanized muscles." Many practitioners, on the other hand, rarely or never prescribe opium, having but little faith in its value in this disease. Mr. D. Gresswell believed opium to be of great value; and we also are of opinion that the hydro-chlorate of morphia, injected hypodermically, is one of the most powerful remedies we have for combating the severity and the length of duration of the paroxysmal seizures.

'Mr. Charles Gresswell, of Nottingham, who has had a large experience of the administration of morphia hypodermically in tetanus, believes that, with chloral hydrate and tobacco, this treatment is as efficacious as any combination of remedies with which he is acquainted.

'We believe that the value of morphia in tetanus is hardly sufficiently appreciated by some practitioners, and we are of opinion that it would, perhaps, be more extensively administered than it is, if its value in combating spasmodic seizures were more generally recognised. It has been pointed out, however, that horses, like men, show great differences in their degree of susceptibility to the action of opium, and this may, in some degree, account for the diversity of opinion as to its value.

'Thoroughbred horses are more easily brought under its excitant action, whereas cart-horses more readily exhibit the soporific effects.

'When morphia does act beneficially in tetanus, the duration of the effect is more lengthened than with several of the other remedies mentioned, and it does not, as physostigmine sometimes does, cause still more exaggerated seizures, when the transient calm produced has passed over.

'That horses will take very large quantities of opium, and still not succumb, is shown by the following case, which we repeat in this connection, although we have mentioned the case elsewhere in these pages:

'"On one occasion we were called in to see a black mare, aged eight years, to which the owner had administered one ounce and a half of Turkey opium. When seen on the day following the administration of the drug, the mare was found to be in a very dull, dejected condition; the pulse was very feeble and soft, and the artery very compressible. The number of beats was eighty-four per minute, and the temperature reached 102·5°. The pupils were contracted, and there was a total loss of appetite, the mare refusing all food and drink. The breathing was slow, but not stertorous, and the nasal mucous membrane was highly injected. The symptoms continued unabated for three days, during which time the animal moved round and round in the box. On the fourth day the pulse began to regain vigour, but recovery was not complete before the lapse of a week."

'CAUSTIC POTASH, OR HYDRATE OF POTASSIUM, AND BICARBONATE OF POTASSIUM.

'*Physiological Action and Value in Tetanus.*—Experimental research on animals has shown that the potash salts, when introduced immediately into the blood, are very poisonous, and this effect appears to be due to the base, and to be independent of the acid with which it is associated (always excepting such compounds as, *e.g.*, the cyanides, whose specific action is that of the combined acid). In cold-blooded animals the salts of potash, even in small doses, cause gradual but complete paralysis of the voluntary muscles, and finally of the heart, which ceases to beat in diastole, and no longer responds to irritation. In warm-blooded animals, the arrest of the heart is preceded by dyspnœa and convulsions. It is not certain whether the paralysis is due to some action of the salt on the nervous system, or on the idio-muscular contractility. Small doses raise the blood pressure in the systemic arteries, and slow the heart; poisonous doses cause immediate paralysis of the heart, and a sudden fall of blood pressure.

'A very simple experiment, which we had the opportunity of witnessing in Leipzig some time ago, will serve to illustrate the poisonous character of the salts of potash as compared with that of sodium. Professor Ludwig, having secured a good-sized frog, washed out the blood, and injected into the veins of the animal a weak solution of chloride of potassium. Death very soon followed; but when chloride of sodium was substituted for chloride of potassium, the animal continued alive for some length of time after the performance of the experiment.

'In addition to their sedative powers, the hydrate and the bicarbonate of potash have, in common with the sodium analogues, distinct antacid powers; and it is on account of these antacid properties that they have been so largely employed in rheumatic affections. The amount of alkali contained in solution of caustic potash, in medicinal doses, is small, and therefore its antacid powers are not very great. After absorption into the blood, free potash is said to increase the change of tissues in the body; and hence it is an alterative. It renders the blood more alkaline, and is said to make the fibrine less plastic. Carbonate and bicarbonate of potash, similarly, are direct antacids; but they have not the sedative action on the mucous membrane of the stomach which the hydrate has. They are readily absorbed, and may be given in large doses.

'According to Dr. Guttmann, poisonous doses of potassium salts paralyze the spinal cord and heart, depress or destroy the functions of afferent nerves, lower blood pressure and temperature, and cause muscular weakness, affecting first the hind extremities. They do not appear to act upon the muscles or peripheries of nerves.

'We believe the hydrate or the bicarbonate of potash to be of great value as an adjunct to other remedies in the early stages of tetanus, and we were first led to employ these remedies as adjuncts from the impression that the acid products of muscular contraction, accumulating in the system, would tend to become neutralized in some degree by their injection. But we have never employed more than the ordinary doses, and have generally used the hydrate, given in the gruel, though we believe the bicarbonate to be perhaps as likely to do good. We do not, however, believe that the beneficial action of the potash salts depends altogether upon their antacid properties, but also upon their sedative properties, regarding which the above is a short abstract.

'We do not believe the potash salts (except the bromide) have been much used in the treatment of tetanus, but we think, from experience in several cases, that they are worthy of still further trial as valuable adjuncts, more especially in the early stages.

'We may conclude our observations on the potash salts by inserting in this connection some remarks (although they occur elsewhere in these pages) regarding some physiological points of importance in the study of the phenomena of muscular contractions :

'"If a nerve-muscle preparation be carefully made and preserved, and the nerve be irritated in any way whatever, the muscle will respond to the application of this new incident force by an aggregate of changes which are collectively spoken of as a contraction.

'" Further, if during the period of the maximum intensity of the contraction another equal stimulus be applied, the additional response will be nearly equal to the first.

'" A lever suitably attached to the muscle will be raised very nearly as much again, and the amount of the two contractions will be nearly twice that of the first alone. If more stimuli of equal intensity be successively applied, with each subsequent irritation, the amount of the consequent contraction becomes gradually less, until at length, when the stimuli reach a certain number in a given time, the lever is not raised higher, but the component contractions are apparently united, fused, as it were, to form a single continuous uniform contraction, and though really still existing, are not to be indicated by ordinary instruments.

'" This condition of a muscle, which is called tetanus, may be produced by the interrupted current, or by any rapidly repeated shocks. The frequency of the stimuli needed to produce tetanus varies in different cases.

'" 'Kronecker and Stirling find that ten stimuli per second will cause complete tetanus in the red muscles of the rabbit, whereas the pale muscles require at least double that number.

'" ' When the stimuli are repeated more frequently than is required to bring about a complete tetanus, the constituent contractions are still proportionately increased in frequency. This is shown by the increased pitch of the muscular sound.

'" ' Kronecker and Stirling, by using a special instrument for rapid interruption, the so-called tone-inductorium, have been able to obtain in all cases a complete tetanus with alternating induction shocks, even when repeated, they believe, as frequently as 22,000 times a second' (Foster).

'"Thus it appears that the number of constituent contractions which may coalesce to form a tetanus is very great indeed, and we can only conclude from this, that in the disease where so many muscles are involved, the expenditure of force entailed is enormous, even if we suppose that the spasms are not of a very complex character—that is, are not constituted by a large number of component contractions.

'"Every time a muscle contracts, there is an expenditure of energy. Work is done; force is supplied, directly or indirectly, by the dissociation of highly complex organic compounds, of whose nature little is known, and thus waste-products are produced."

'QUININE, SALICINE AND SALICYLATE OF SODIUM, AND SALICYLIC ACID.

'*Physiological Action and Value in Tetanus.*—Quinine has a powerful sedative influence upon the spinal cord and brain, diminishing, and finally abolishing, reflex movements. It lowers the heat of the body in healthy animals, but this action is most manifest in the pyrexia artificially induced by the injection of putrilage into the circulation. It is probable that this effect is due to the *checking of oxidation within the organism.*

'We have administered quinine, with salicine, in some cases of tetanus, and believe it to have a beneficial action in this disease. Mr. D. Gresswell also administered quinine sulphate in several cases of this affection, and never observed any ill effects attending its administration. He, too, administered the quinine along with salicine. The effects of salicylic acid closely resemble those of quinine, but it is more depressing in its action than salicine, and is less rapidly absorbed than the salicylate of sodium.

'TOBACCO AND NICOTINE.

'*Physiological Action.*—Nicotine causes in frogs tetanus and general paralysis. In warm-blooded animals there occur twitchings and tetanoid convulsions, excited by the slightest stimulus.

'It tetanizes by its action on the cord. It paralyzes the cord and motor nerves (Vulpian, Rosenthal, Krocker), the peripheral nerve-endings being first affected; it also paralyzes the muscles (Rene). The brain is unaffected (Ringer's "Therapeutics"). It also appears to tetanize the heart, and kills by arrest of respiration.

'In medicinal doses, tobacco causes motor depression and muscular relaxation. As a motor depressant, it is said to be allied to pituri, to hemlock, and to lobelia inflata, or Indian tobacco. Calabar bean and prussic acid are more immediate and direct depressors of the cord.

'*Value of Tobacco and Nicotine in Tetanus.*—Both tobacco and nicotine, $C_{10}H_{14}N_2$, have been extensively administered in tetanus in horses and in the human species.

'In man, nicotia has been highly lauded for this disease, and many cases seem to show its beneficial action. It must be given in man either by the rectum or hypodermically, as when put into the mouth it very generally excites a severe paroxysm, which may destroy life by firmly fixing the muscle of the chest, till asphyxia is produced.

'To the horse, tobacco has been given by the mouth in the form of powder, by the rectum as an enema, and hypodermically as nicotine. Mr. D. Gresswell believed tobacco to be one of the most valuable remedies of the pharmacopœia in the treatment of tetanus, and latterly he used it in almost all cases. Our experience also of the use of tobacco, in different forms, is very satisfactory, and we nearly always prescribe it now. Mr. Charles Gresswell, of Nottingham, has also found tobacco to be one of the most efficacious remedies as yet advocated for the treatment of tetanus, and many other practitioners are also satisfied of its power in restraining the violent spasmodic seizures and of curtailing their duration.

‘CONCLUSION.

‘We have mentioned incidentally, in treating of the value of the several remedies, the ones on which we are disposed to have the most reliance in tetanus, and we shall therefore not take up further space by repeating our opinion. But we should state that our deductions are drawn from a very careful analysis of more than two hundred and ninety cases of idiopathic and traumatic tetanus, which have occurred in the practice of the late Mr. D. Gresswell, in our own practice, and in that of Mr. Charles Gresswell, as well as in that of other practitioners, who have either called in Mr. D. Gresswell, or have made known to us the special treatment adopted and its result. There is no doubt that rest and general management in all cases of tetanus have a large part in determining the result, quite apart from the combination of remedies employed ; and it is well known that some cases are from the first of so severe a nature that all treatment and care prove utterly unavailing. Most assuredly the largest percentage of cures may be expected where greatest care is taken, and a judicious combination of the most efficacious remedies administered.

‘We may, in this connection, mention that our analysis of the above cases leads us to have no faith in the efficacy of conium, conia, and but little in that of belladonna, atropine, and cannabis Indica.

'We are disposed to regard nicotine, tobacco, morphia, aconite (in the early stage of severe cases especially), chloral hydrate, and hydrocyanic acid, as among the most efficacious remedies, and as an adjunct we value potash highly, as also, in some instances, the inhalation of chloroform.

'We have little faith in physostigmine, as its effects are very transitory, while of amyl nitrite our experience is too limited to speak with any authority. Regarding the treatment of injuries, we believe authorities are agreed, excepting in cases of tetanus following docking. It was the practice of Mr. D. Gresswell to re-dock in all cases following this operation.

'We ought *to mention* that the bowels were kept open in the above cases by the administration of calomel, and in some by small doses of aloes in the first instance. Finally, we should add, knowing that the alkaloidal salts and other preparations vary much in their quality and strength, that we obtain a large number of our drugs from Messrs. Wright, Layman, and Umney, whose preparations are always of first quality and thoroughly reliable.'

ENZOÖTIC PARAPLEGIA — GRASS-STAGGERS.

Definition.—'Is a disease affecting horses feeding on rye-grass at a particular period of its growth, and characterized by disturbance of the innervation, especially by impairment or loss of motor, and more rarely of sensory, power of the posterior extremities' (Robertson).

Nature and Etiology.—Enzoötic paraplegia rarely or never occurs when fed on any food save rye-grass at a particular period of its growth; and we believe with Mr. Robertson that it is to be regarded as a different affection from that termed 'stomach or sleepy staggers.' In the disease under consideration, spinal symptoms are the essential features, though cerebral symptoms may be also developed, especially in severe cases.

In stomach staggers, on the contrary, cerebral symptoms are essential features.

This reflex or sympathetic paraplegia does not seem to have any relation to the quantity of the food taken, but only to its quality; and it appears as an enzoötic affection where horses are grazed on land where rye-grass abounds.

Cattle and sheep are also liable to become affected through eating rye-grass; and although some seem to regard these morbid states in ruminants as being similar to reflex paraplegia, Mr. Robertson is rather doubtful of any similarity.

According to this authority, 'acute diseases of animals, intimately associated with or resulting from dietetic causes, are all, or nearly all, apparently referable to changes in connection with the cerebral part of the system, and paraplegia alone is not a diagnostic feature of them.'

It must be remembered that ruminants seemingly have a greater power of resistance against most vegetable poisons, and whereas the horse, when grazing, is disposed to eat the flowering stems almost entirely to the exclusion of the foliage of the plants, the ox crops both foliage and seed stems, and the sheep mostly keeps closely to the root foliage. It is, therefore, not to be wondered at if dissimilar symptoms are manifested by these animals.

The immediate cause of the reflex paraplegia seems to be due to the tonic influence of the rye-grass while the seed is being matured.

In some of the features the disease appears to bear a certain resemblance to ergotism.

Symptoms.—The symptoms are gradually developed, and the animal manifests deficient controlling power over the voluntary muscles, especially in those of the hind extremities.

The weakness gradually increases, and the animal reels or staggers.

There is usually no unconsciousness, and in most instances the animal continues in the standing position.

The appetite does not generally suffer, and though the pulse is accelerated and temperature elevated in severe cases, they are nevertheless, in the general way, not altered.

The bowels are generally constipated. Muscular spasms are occasionally developed.

When the animal falls, the muscular spasms are sometimes very severe; consciousness becomes impaired; the breathing becomes stertorous, and death soon closes the scene.

Prognosis and Morbid Anatomy.—The mortality is small, and when the cases are attended to in the early stages death is very rare.

The post-mortem appearances are neither very characteristic nor well made out.

Treatment.—The animal should be removed to a fresh pasture, in the first place.

In most instances recovery then follows without further treatment.

If a purgative medicine be given at first, the animal should be brought up to the stable.

Tonics, such as gentian, ginger, and nux vomica, may follow the administration of the purgative.

CHAPTER XI.

EQUINE ENTOZOA.

THE entozoa which infest the horse are divided into four groups—

I. TREMATODA, or FLUKES.

The trematodes are so called because their bodies are studded with little perforations or suckers.

The word 'fluke' is derived from an old Saxon term signifying anything flat.

Flukes are oval or flat, but they may be spherical, whilst others, such as the Bilharzia, are more lengthened.

This group is divided into several families, according to the number of mouths they possess. The six families recognised are as follow:

1. Monostomidæ.
2. Distomidæ.
3. Amphistomidæ.
4. Tristomidæ.
5. Polystomidæ.
6. Gyrodactylidæ.

The chief flukes recorded as having been found in the horse are—

(A.) **Fasciola Hepatica**, otherwise known by the name of Distoma Hepaticum, or the Liver Fluke.

This parasite, although occasionally found in the horse, is more commonly encountered in the ass. Very few cases only are recorded of this worm being found in the horse, and, when present, it generally appears to be harmless.

The life history of this interesting parasite will be more appropriately treated of in works on Bovine and Ovine Medicine.

(B.) **Amphistoma Collinsii and Stanleyi.**—These species are rarely found in the colon of horses, and are liable to set up intestinal irritation. The fresh specimens are of a brick-red colour, and have been sent from India.

(C.) **Gastrodiscus Sonsinonis.**—This amphistome, which exceeds half an inch in length and one-third in breadth, was discovered by Dr. Sonsino in the carcases of solipeds which died in the Egyptian plague in 1876.

II. CESTODA, or TAPEWORMS (κεστος, a girdle).

This group includes not only the tapeworms, but also the cystic worms. The members of this group have two distinct phases of existence. In the one, the scolex of the parasite is connected with a so-called cyst or bladder, and is buried in the solid tissue of the host. In the other, the adult tapeworm is found in the alimentary canal.

The adult worm is made up of a number of proglottides fastened on to a scolex, or head, which is fixed on to the mucous membrane of the gut. A fully matured tapeworm is thus in reality composed of a colony of zooids.

Life-history of a Tapeworm.—When the proglottides, or segments of the adult worm, become mature, they pass off with the fæces. Each segment contains a quantity of ripe eggs; these, becoming scattered about, may gain access to the alimentary canal of a suitable intermediary host. In this new situation the six-hooked embryo which is contained in the egg breaks its shell and obtains its liberty. The immature worm or embryo now passes through the intestinal wall and wanders about until it arrives at a spot suitable for its development into a perfect cyst.

In this condition it will remain and perish, unless its host dies or is killed. In the latter case it may gain access to the intestinal canal of another host fitted for its further existence, and in this case the scolex fixes on to the gut, and the proglottides slowly develop.

It is very rare that the same animal serves as host both for cyst and adult worm.

Some tapeworms have hooks on their proboscides, others are devoid of hooks.

The chief tapeworms of the horse are:

(A.) Tænia Plicata.—This worm varies in length from six inches to three feet. It has a short neck, and a body composed of narrow segments, which give to the worm a blunt serrated margin. Its habitat is usually the small intestine, although it has occasionally been found in the stomach. Of all equine cestodes it is the largest.

(B.) Tænia Perfoliata.—The length of this parasite is from one to three inches; it may, however, be five inches long. It may be recognised by the two fleshy lobes, the almost indistinct neck, and the visible narrowing of the segments as they near the tail. The favourite habitat is the cæcum and colon, where this worm is sometimes found in large numbers. Of equine cestodes, it is the most common, and may give rise to serious disturbance.

(C.) Tænia Mamillana.—This member of the group is about half an inch long, and has no obvious neck, no lobes, and is made up of wedge-shaped segments with prominent reproductive papillæ. It infests the colon.

Treatment of Tapeworms.—Such drugs as oil of male fern, absinthe oil, or oil of turpentine, should be given.

Cestode Epizoöty.—This epizoöty occurred among some ponies in South Wales, and among the prominent symptoms were extension of the head, the animals appearing as though suddenly distracted, rubbing the quarters, running and rolling about for a few minutes, then getting up again, and appearing to be well again. If coming down a slope the animals would fall, and in some cases there was lameness in one hind-leg.

Source of the Tapeworms of the Horse.—The cystic forms of tænia placata, tænia mamillana, and tænia perfoliata, are as yet unknown.

Probably their larval forms exist in the bodies of different insects.

Larval Forms of Tæniæ.—Larval forms have received various names, according to their contents, viz.:

1. *A Cysticercus* is a cyst filled with serum, and provided with only one head.
2. *A Cœnurus* is a cyst filled with serum, and provided with many heads.
3. *An Echinococcus* is a primary cyst, which contains, or which gives rise to, secondary cysts filled with serum, each provided with numerous heads.

LARVAL FORMS OF TÆNIÆ OF THE HORSE.

The larval cestodes of the horse are, comparatively speaking, somewhat rare. The one most frequently met with, however, is that of the Tænia Echinococcus.

1. ECHINOCOCCUS VETERINORUM.—This cystic worm is the larval form of the tænia echinococcus, which infests the small intestines of the dog and wolf.

The adult tapeworm is composed of four segments, or joints, and is a little over a quarter of an inch in length. The first joint includes the head, which is about $\frac{1}{100}$ of an inch wide, and is provided with four suckers, a double coronet of hooklets, between thirty and forty in number, and a central rostellum.

The fourth segment is as long as all the rest of the worm; and is alone supplied with sexual organs.

The cyst, larval form, or hydatid, which has received the name of echinococcus veterinorum, is characterized by almost indefinite increase in size, and by almost indefinite multiplication by the formation of gemmæ.

This cyst, in its early form, is small and globular, with transparent walls and finely granular contents. In its later stages, when it has much increased in size, the walls become thick and the contents fluid.

The colourless fluid and limpid contents contain a quantity of salt, and usually no albumen.

The walls are composed of two coats, an outer, which is fairly thick, transparent, elastic and laminated, and an inner, which is thin, and made out of fine cells, sometimes containing oval or globular refractive bodies.

In some cases the hydatid is only increased in size, but as a rule secondary cysts form in the substance of its walls. The cysts grow—some towards the outer aspect, some in the mid-region, and some towards the inner aspect, and often in connection with the cellular laminæ.

The secondary cysts often repeat in their growth all the characters of the parent hydatid.

This hydatid may be found in various organs and glands of the body, especially the lungs, liver and kidneys, and sometimes in the brain. They vary much in size, sometimes being as small as a pea, and occasionally encountered as large as a good sized cocoa-nut. They may or may not produce symptoms which vary according to the organs affected, and the size and exact position of the cyst.

2. **CŒNURUS CEREBRALIS.**—This hydatid is the larval

form of the tænia cœnurus of the dog. Its full description will be more appropriately treated of in works on ovine pathology.

It is rarely found to affect the horse, one authenticated instance of its presence in the brain only being recorded.

3. **CYSTICERCUS FISTULARIS**, or Long Bladder-worm of the horse, is probably only a variety of the C. tenuicollis of ruminants.

The muscle-flesh of horses is not liable to be infested by cysticerci.

III. NEMATODES, OR ROUND-WORMS.

The nematodes (νεμα, a thread) comprise not only the round-worms, but also the thread-worms and the strongyles (this latter term meaning round or cylindrical).

Included in this group are several families, among which are the

1. Ascaridæ.
2. Cheiracanthidæ.
3. Cucullanidæ.
4. Strongylidæ.
5. Trichinidæ.
6. Oxyuridæ.
7. Trichocephalidæ.
8. Filaridæ.
9. Gordiidæ.
10. Anguillulidæ.

The chief nematodes which infest the horse are the following:

1. **ASCARIS MEGALOCEPHALA**, or Lumbricoid Worm. —This worm is distinguished from the lumbricoid worm of man and pigs by its greater number of caudal papillæ. In length, the male of this species is rarely over seven inches,

but the female may attain a length of sixteen to eighteen inches.

This worm has a smooth body with transverse rings, and may occur in any part of the intestinal canal, although it is especially found in the ileum and small intestine.

With regard to the question how horses become affected, Dr. Cobbold writes: 'It is not likely that any intermediate host is necessary for the growth of the larvæ, prior to their access to the definite host. I have reared the larvæ in impure water and in moist horse-dung up to the size of $\frac{1}{30}$ of an inch. They were then furnished with a completely formed digestive apparatus.' Davaine kept the intra-chorional embryos alive in water for five or six years.

It is noteworthy that the eggs of lumbricoids effectually resist dryness, and it is possible that horses become infected with the ascaris by drinking out of ponds containing sewage matter.

The equine ascaris may prove fatal by setting up enteritis, or by overcrowding it may cause rupture.

Treatment.—Allow nourishing diet, and give internally a brisk cathartic, *e.g.*, aloes, with ʒi. of antim. pot. tart., and follow with vegetable tonics, sulphate of iron, and doses of santonine.

Preventive Measures.—See that the water-supply is good, pour boiling water on all worms passed, and attend to the drainage.

2. **STRONGYLUS ARMATUS.**—This worm has long been known to naturalists, and was formerly described as two varieties, major and minor, which are now proved to be the same worm in different stages of growth.

Description.—The body of the worm is rigid, the head lobular, flattened, truncated, and armed with numerous upright denticles, like a circular saw.

The posterior ray of the hood of the male is three cleft.

The males are about one and a half inches long and the females two inches.

The eggs, which are elliptical and somewhat constricted at the centre, pass from the parent worm and host with the fæces.

In a few days the rhabditiform larvæ are hatched, and in three weeks' time change their skin in mud, and at the same time part with their tails.

They next gain access to the bodies of some intermediary host, where they are still further matured, and from this gain access to the horse.

From the intestinal canal they get into the small vessels of the intestine, and pass on to the larger arterial trunks, producing aneurism, caused by inflammation and thickening of the intima (endo-arteritis).

Lastly, these parasites make their way out of the vessels, and from thence endeavour to regain the colon, where they again change their skins, and, adhering to the mucous lining of the bowel by means of their spines, attain sexual maturity. During their wanderings they are apt to stray.

The following remarks on certain pathological conditions in testicles of horses are taken from the *Veterinary Journal* for 1886, vol. xxii., pp. 86, 87:

'It is my purpose to describe, very shortly, some instances of diseased testicles in horses, as I believe that, although not of very uncommon occurrence, they may, nevertheless, prove of some interest to the readers of the *Veterinary Journal*.

'On December 25th, the writer was summoned to make a post-mortem examination on a cart-horse, which had been attended by a local practitioner. On opening the abdomen, it was easily seen that the animal had died from an extensive rupture of the colon. In the inguinal region there was an immense tumour, about the size of a man's head. Being interested as to the exact pathological condition of this swollen testicle, I removed it, and examined the organ carefully. The skin covering it and all the tunics were firmly adherent to the gland, but after considerable trouble the testicle and the cord were dissected out. The whole mass weighed five pounds and six ounces; the testicle and cord alone weighed four pounds and three ounces. On cutting into the testicle, the true gland tissue was found to be replaced by firm fibrous tissue, interspersed with fat, and in the centre there was a cavity, of the size of a small orange, containing caseous matter, pus, and a number of well-developed strongyles, which I have no hesitation in pronouncing as specimens of strongylus armatus. Two of these are remarkably well developed, and the internal structure is seen to be of a bright-red hue.

'Last summer I was called upon to castrate a colt, with its off-side testicle in a condition similar to the above. In this instance the gland weighed nineteen ounces and three drachms. The coverings of the testicle and the skin of the scrotum were likewise firmly adherent in this case. During the operation the hæmorrhage was considerable, and proceeded mainly from a large quantity of cellular tissue developed around the gland and the cord. The microscopical features of the two testicles revealed the same pathological fibrous and fatty degeneration. Although such *degeneration* is not uncommon in horses, I have never before met with a small colony of the armed strongyles in this situation.'

Verminous Aneurism.—Occurs in a large percentage of horses and asses, and is especially found in the aorta and anterior mesenteric artery.

These aneurisms assume various forms, *e.g.*, thumb-shaped, or bottle-shaped, etc. They may be simple or compound, and vary in size from a pea to a man's head, and occur in animals six months old and upwards. The number of worms in one aneurism varies, and is usually nine to ten, the highest number in one horse being 121.

We append a few extracts of Dr. Cobbold's summary of the results of Bollinger's investigations of this worm:

> 'The favourite seat of the worm-aneurism is the trunk of the anterior mesenteric artery, directly at its origin from the abdominal aorta. Most frequently that part of the arterial trunk is dilated, from which the arteria ilia, cæcales, and colica inferior (arteria ilio-cæco colica) arise, less frequently the arteria colica superior at its origin, and the arteries of the cæcum and colon in their course in the meso-cæcum and meso-colon. The verminous aneurism also occurs in the cœliac artery (Bauchschlagader), in the posterior mesenteric artery (gekros-arterie), in the renal artery, and in the abdominal aorta. A horse is not unfrequently afflicted with several aneurisms of this kind at one and the same time. Thus, in one case (described by Bollinger) there were six of these aneurisms affecting the abdominal aorta and its branches in the same horse. The verminous aneurism may occur from the sixth month of life onwards; and with increasing age, the number of horses free from such aneurisms becomes continually smaller.
>
> 'The walls of the aneurism are, almost without exception, indurated. In addition to the mesenteric connective-tissue, all the arterial coats, and especially the tunica media, generally take part in this induration.
>
> 'The changes in the intima present all stages of progressive and retrogressive metamorphosis, and are the least constant.
>
> 'The changes vary from simple induration to ulceration and calcification. In addition to the palisade worms, one almost constantly finds a parietal thrombus contained in the aneurism. It covers the inner walls, either partially or completely, being in the latter case perforated by arterial offshoots. This clot may occlude the artery, and it is not unfrequently continued into the arterial branches (peripherally), or into the aorta (centrally). Amongst the various changes that the clot undergoes, organization of its outermost layer and softening are the most frequent. The constant occurrence of this clot is due to the presence of the worms, to the inflammation, ulceration, and retrogressive affection of the intima, and to the dilatation of the arterial tube.'

3. **STRONGYLUS TETRACANTHUS**, or Four-Spined Strongyle.—This nematode is found in large numbers in the horse, ass, and mule, and though not an uncommon cause of epizoöty in this country, is not so frequently met with on the Continent.

These parasites infest the cæcum and colon. Concerning this parasite Cobbold writes: 'The males and females are of about equal size, the largest females reaching nearly three-quarters ".'

In the sexually immature condition the worm occupies the walls of the large intestine, where it gives rise to congestion, ecchymosis, inflammation, and the formation of pus deposits.

The species is readily recognised by its bright red colour, by the four conical spines surrounding the mouth, by the two neck-bristles, and by the three-lobed long head of the male, and by the posterior three-cleft ray having a rudimentary or fourth branch attached to its outer edge.

The head, when viewed in profile, is truncated, and from above it is round. The body is smooth, and presents indistinct rings.

Development.—The eggs of the worm probably gain access to the intestines of small insects, and the immature form is swallowed by the horse in the water or in the fodder.

The worms then become encapsuled in the mucous membrane of the large intestine, and are about three to six millimetres long when uncoiled.

In this condition the sexual apparatus is not developed; and the skins are cast while the worm is still in its capsule.

Dr. Cobbold, writing concerning the remaining history of the development of these worms, says after escaping the walls of the intestine, the worms re-enter the lumen of the bowel to undergo another change of skin prior to acquiring the adult state. They do this by rolling themselves within fæcal matter of the horse's intestine. In this state they lie coiled up in a kind of cyst or cocoon.

In some districts the worm is not often met with, while in others it is most destructive. Mr. R. Lloyd was the first who recognised this worm as the cause of Welsh epizoötic outbreaks.

The worm gives rise to emaciation, colic, diarrhœa, and sometimes to inflammation of the bowels.

Sometimes the intestinal pain is very acute, and the animal rolls and tosses about in great agony. In other instances abdominal pain is not a marked feature.

Treatment.—A purgative should be given in the first instance, and should be followed up by mashes, and afterwards by good nutritious food and the administration of tonics and stimulants.

Some practitioners recommend the administration of turpentine; but in our hands it has not proved of much benefit.

4. **OXYURIS CURVULA**, or Pin-worm.—This worm is partly transparent, and is marked with transverse striæ.

In length the males are one and three-quarter inch, and the females from three to four inches, or even more.

This worm has a long subulate tail. The usual habitat is the entire length of the colon, where they are apt to set up local irritation.

The eggs accumulate round the anus; and, according to Cobbold, horses directly become infected with the worm by ingesting the eggs.

Treatment.—Give cathartics and enemas; the latter should be medicated.

5. **SPIROPTERA MEGASTOMA**, or Large-mouthed Maw-worm.

The length of this species is from one-third to half an inch, the females being a little longer than the males.

Dr. Cobbold thus describes this worm: ‘The males are one-third of an inch and the female half an inch long. Around the mouth are four thick horny lips, the dorso-ventral being the larger. The tail of the male is spirally twisted, and supplied with lateral bands, supported by three or four ribs. It carries two curved spicules of unequal size. There are five pairs of caudal papillæ, and the tail is bluntly pointed in both sexes. The vulva of the female is about one-seventh″ below the head. The eggs are linear, narrow, and possess thick shells.'

The parasites are found in tumours in the walls of the stomach, especially at the cardiac end; the tumours usually contain a bundle of worms together with pus.

The tumours are apt to rupture, and the contents escape into the peritoneal cavity.

6. **SPIROPTERA MICROSTOMA.**—This species, which may probably be regarded as a variety of spiroptera megastoma, is found free in the stomach, and does not appear to be productive of injury.

7. **STRONGYLUS MICRURUS**, or Lung-worm.—This parasite, although so productive of bronchitis in calves, rarely occasions serious results in solipeds. However, it is not unfrequently found in the bronchial tubes of asses and horses on post-mortem examination.

8. **STRONGYLUS GIGAS**, or Renal Strongyle.—This worm has been found in the kidney of the horse. In 1792 it was observed by M. Chabert, and reported or witnessed by Rudolphi and Leblanc.

9. **FILARIA LACHRYMALIS**, or Small eye-worm.—This thread-worm has been found between the lids and eyeball of the horse.

The males are half an inch long, and the females two-thirds of an inch. It is viviparous.

10. **FILARIA PAPILLOSA**, termed by some Filaria Oculi.

The males are two to three inches long, the females five to seven inches.

Description.—The head is broad; the mouth wide, and surrounded by a ring of chitine, and possesses two denticles. On the neck are two papillæ, near the middle line;

besides sixteen caudal papillæ, eight on either side. The tail of the male is spirally twisted; the tail of the female slightly curved.

This worm infests the globe of the eye and its tunics, and is often contained in a cyst within the cornea. It is also found in the thorax, abdomen, membranes of the brain, muscle, and cellular tissues.

Dr. Manson considers that the eye is not the usual habitat for this parasite.

The tracks of this worm may be readily seen.

11. **FILARIA SANGUINIS EQUI.**—These microscopic nematodes were found by Dr. Sonsino in the blood of an Egyptian horse.

IV. ŒSTRIDÆ, OR GADFLIES.

GASTROPHILUS EQUI, or Common Gad-fly, or Œstrus Equi.—**Description.**—The bot, which is the larval form of the gad-fly, has eleven segments arranged in double rows, and is of a red colour. The head is narrow and pointed, and the mouth is small, and placed between two large hooks or maxillæ. Between the hooks are two horny plates, called mandibles. The tail is broad, truncated, and flattened at the end.

Development.—The gad-fly attacks the animals in late summer to lay its eggs, and this is done by fixing them to the neck, shoulders, and inner part of the fore-leg, especially about the knees, by means of a sticky or glutinous secretion.

The horse licks these parts with his tongue, and in less than three weeks after being first deposited the larvæ escape.

From the tongue they gain access to the stomach, where they fix on to the mucous membrane by means of their hooks.

When they attain their full size they become loose, and escape with the fæces and bury themselves in the soil, where they are transformed into pupæ.

Having remained in the earth about six or seven weeks, they emerge from their pupa cocoons perfect dipterous insects.

The *male* insects die, and the females live long enough to deposit their eggs, which are generally about forty in number.

The *bots* of the horse live in the stomach in winter months, leave in spring or early summer, and remain in the soil six or seven weeks.

The *fly* is developed in June to September, and after the latest females have appeared all perish in October.

The bots are as a rule comparatively harmless, but cause injury where great numbers are aggregated together. They may cause rupture, perforation, or tetanus.

Treatment.—Give a full dose of sulphuric ether (two fluid ounces) at a time when the stomach is empty.

GASTROPHILUS HÆMORRHOIDALIS.—The larvæ are found attached to the walls of the rectum.

GASTROPHILUS NASALIS.—The larvæ attach themselves to the duodenum, near the pylorus.

The following is an extract from 'Diseases and Disorders of the Horse,' pp. 79, 80.

'All our readers have heard of the gad-flies which prove so irritating to oxen by piercing through their hides. The female gad-fly settles on its victim while out at grass, late in the summer, not for the sake of deriving sustenance for herself, but for that of providing a suitable habitat for her eggs. It is at this time of the year that she deposits her eggs on the hairs of the coat, and this she is enabled to do by means of a thick sticky fluid. The fly generally selects, as sites for depositing her eggs, those parts of the horse which the animal can reach easily with the tongue, namely, the shoulders, the lower part of the neck, and the inner parts of the forelegs, especially around the knees. The horse frequently licks the portion of coat on which the eggs have been deposited. They gradually become hatched in about three weeks from the time of their deposition by the gad-fly, and the larval form, or maggot, makes its escape out of its enclosing eggshell. The maggots are then carried to the horse's mouth, and ultimately to his stomach along with his food and drink. Necessarily, as Professor Williams points out, many larvæ perish during this passive mode of immigration; some being dropped from the mouth, and others being crushed in the food during mastication; but notwithstanding the waste, the interior of the horse's stomach may become completely covered with the larvæ, commonly termed "bots."

'When the bots, which hold on to the lining of the stomach by means of two large hooks, are perfectly grown, they release themselves, and are carried through the intestines along with the excreta, and thus they finally fall to the ground. They then bury themselves below the surface, in order to undergo a transformation from the condition of the bot to that of the pupa or chrysalis. When they have remained thus buried for six weeks, they make their way out of their enclosing cocoons, and emerge as perfect gad-flies. The male insects die, but the females live long enough to deposit their eggs, which are generally about forty in number. The bot passes about eight months of its existence in the stomach, where it is present in the winter months. It leaves in spring or early summer. The fly is developed from June to September, and after the latest females have appeared, all perish in October. Not uncommonly the presence of bots in the stomach of the horse gives rise to considerable mischief. When very numerous, they may set up serious disease, sometimes even perforating the walls of the intestines. It is not always possible to diagnose the presence of bots in the stomach, but not unfrequently they may be seen in the excrement, or adhering around the anus. When there is reason to suspect their presence in very large numbers, it is well to place a piece of rock salt in the horse's manger, and to administer a drench, consisting of spirit of ether two ounces, of glycerine of carbolic acid two drachms, and of linseed-oil a pint. This may be repeated once every day for four days.'

CHAPTER XII.

TOXICOLOGY.

A KNOWLEDGE of the actions of, and symptoms produced by, certain drugs and reagents, recognised in toxicology under the term 'poisons,' is of great importance to the veterinary practitioner.

For a full account of the manner in which different poisons may be absorbed into the system, and for the detailed methods by which they may be detected, we must refer the reader to such works as 'Taylor on Poisons,' or Dr. Tanner's little work.

Here we intend to treat of arsenical poisoning, acute and chronic; lead poisoning, acute and chronic; and also, as shortly as possible, of poisoning by antimony, corrosive sublimate, hellebore, yew-tree foliage, opium, savin, bryony, water drop-wort, euphorbium or spurge, and cantharides.

ARSENICAL POISONING.

This metallic poison is usually administered to the horse in the form of arsenious trioxide, or common white arsenic.

This substance is very commonly given by labourers and waggoners, and more rarely by grooms, in certain parts of the country. When given in excessive doses it is generally through ignorance, but in rare instances may be administered with criminal intent.

The drug is usually given in bolus, made up with soap, tar, or sulphur, or indeed with any suitable substance. Sometimes it is administered as a powder in the food or water.

Symptoms and Post-Mortem Appearances.—The following accounts will serve to indicate some of the more important symptoms and post-mortem appearances of arsenical poisoning in the horse. We propose to draw attention, firstly, to an outbreak which occurred on a Thursday morning, some time ago, on a large farm on the Wolds, near Louth.

When called in, at 3 a.m., four cart-horses were found to be in a very dangerous state. They were fine heavy animals, in excellent condition, and on the previous day had shown no signs whatever of ill-health. Their restlessness first attracted attention about 12 or 1 a.m. When examined, they were observed to be breathing rapidly, the respirations varying from 30 to 40 per minute. The arteries were in a state of extreme contraction; the submaxillary artery, indeed, feeling like a mere thread. The rate, also, was much accelerated; in one case, the pulse reached 108; in another, 96; in a third, 80 per minute; while in a fourth it was entirely imperceptible. The weakness and irregularity of the pulse were very marked. The temperature varied: the highest was 105·5°; and in the other three it reached 104°, 102·5°, and 101·8° respectively. All four animals were purging violently, with extreme tenesmus, and they were in great pain. They got up and down alternately, rolled over and over, and manifested other signs of intense agony. Their extremities were cold. and the visible mucous membranes injected. The eyes were staring, and the pupils much dilated. There was entire loss of appetite and extreme prostration. Eructations of gas frequently passed from the stomach and intestines.

The horse with the imperceptible pulse died at 10 a.m., a second died at 4 p.m., and a third at 10.30 p.m. Before death the animals became still more restless, the pulse was weaker, and finally imperceptible; the mouth became clammy, and the breath fœtid, and they succumbed at length in a state of extreme agony and collapse. One became quite comatose before death, and another had tetanic spasms; the remaining animal recovered. For a time this horse remained so weak and debilitated as to be incapable of rising without assistance; at length, however, he made a gradual and apparently complete recovery, but was not able to resume work for three or four months.

On the following day a careful post-mortem examination was made in each of the three fatal cases. *Thorax*: The lungs were found to be much congested; the endocardium of the left ventricle was highly inflamed, and patches of ecchymosis were found studding its surface in several places; the left ventricle was full of black coagulated blood. *Abdominal cavity*: The stomach was found to contain much undigested food, and the contents were tinged with blood. The cuticular portion had several small patches of redness, and its walls were eroded, in one of the three cases, near its junction with the villous portion. The villous portion was of a dark-brownish-red hue, being intensely inflamed, and covered in parts with a film of coagulated lymph.

It was blackened in patches, and in parts was of a dirty yellow colour; while in some places the walls were much eroded, forming many large eschars, and in other places the mucous membrane was raised in the form of small bullæ, these being produced by effusion of blood beneath the lining membrane.

In one of the cases there were two almost complete perforations through the walls.

The small intestines contained much dirty grey mucus, and presented patches of acute inflammation. The large intestines also showed signs of inflammation, the mucous membrane being reddened in patches. The peritoneum showed spots of ecchymosis in various places.

The brain was not examined.

Though the waggoner denied having administered arsenic, it was afterwards elicited that he had given to each of the horses a quantity of arsenious acid, made into balls by mixing it with tar.

It was calculated that each horse received about ʒiv. to ℥i., but it was not possible to ascertain the exact amount.

This he had given at about 8 or 9 p.m. on the previous day, April 11th.

The symptoms here recorded, and the pathological lesions found, are characteristic of acute arsenical poisoning; and arsenic in abundance was found in the contents of the stomachs. But the effects of arsenic vary much with the amount given, and with the method of administration.

About 11 p.m., on June 20th last year, we were summoned to a team of four cart-horses belonging to a farmer who lived a few miles from Louth. The symptoms in these cases were much less severe than those above described.

The pulses were 90, 72, 60, and 62 respectively, weak and fluttering. The submaxillary artery was contracted, and felt like a mere thread. The respirations were also increased, the legs and ears cold, and there was total anorexia.

One of the animals, an old cart-mare, became violently purged about 12 p.m., and the liquid fæces were blood-stained; the mare died at 2 a.m. on the following day, and the autopsy revealed pathological conditions somewhat similar to, but much less marked than, those described in the previous case.

The other three animals made a gradual recovery, and were soon again at work.

It was ascertained in these three instances that arsenic had been administered in the form of powdered arsenious trioxide. The waggoner had for some time previously given to each of his horses every night as much as he could place on the end of a large pocket-knife. But on the night when the horses were so suddenly affected he had given an extra dose to each, three or four hours previous to the appearance of symptoms of poisoning. Probably each horse had received from two to three drachms.

Several months afterwards we took the opportunity of examining two of the horses again; both had an intermitting pulse, irregular in rhythm and volume. The foreman told us that they had never regained their previous strength. Their appetite was somewhat impaired, and when out at work they were far more easily fatigued than the other horses, and breathed violently when any additional strain was put upon them.

After the administration of vegetable and mineral tonics, they made considerable improvement. Their condition was doubtless in part or wholly due to *the effects of the arsenious acid on the endocardium lining the left ventricle of the heart, and, indeed, a distinct mitral murmur could be heard in one of the cases. This murmur was systolic in time.* That arsenic, when given in solution, acts much more rapidly and powerfully is shown by the following record of nine cases of poisoning which occurred in Mr. D. Gresswell's practice some years ago.

One of the waggoners on a large farm, having obtained a pound and a half of powdered arsenious trioxide, stirred it up in a tub of boiled linseed gruel. This was served out equally to nine horses on their return from work at two o'clock in the afternoon. Very shortly afterwards, viz., about half an hour, the horses began to manifest considerable uneasiness, and the owner in consequence telegraphed to Louth. When Mr. Gresswell arrived he found that eight of the horses had died; but the ninth case, which had an almost imperceptible pulse, recovered under careful treatment.

The time that had elapsed between the administration of the poison and the death of the animals varied from one hour and fifty-five minutes to two hours and thirty minutes.

The horse which recovered remained very debilitated for many weeks afterwards.

Each horse, it is believed, received from an ounce and a half to two ounces of arsenious trioxide, partly in a state of solution, partly in a state of mechanical suspension.

We might record many other cases, but the above will suffice to illustrate the main symptoms produced in the horse by large doses of arsenic.

We may now say a few words concerning chronic arsenical poisoning in the horse.

In February last we were called to see a valuable seven-year-old hunter, belonging to a gentleman residing a short distance from Louth. The horse had an excellent appetite, but was in poor condition. On examination the pulse was found to be fairly strong, but irregular, losing one beat in every six. The respirations were somewhat accelerated. We were informed that when galloped, even for a short distance, the horse breathed laboriously, and could only with difficulty be induced to go beyond a fair trot.

It was ascertained that for many months previously the late groom had given to the horse small doses of arsenic at regular intervals. The symptoms presented were to be attributed to this practice, as the horse always enjoyed perfect health previously, and made much improvement when the groom left.

Diagnosis.—The history of the case will aid us in forming a diagnosis in some instances.

The thread-like character of the pulse, and the purging with extreme tenesmus in severe cases, will assist us in diagnosing acute arsenic poisoning from enteritis.

Detection of Poison.—In the solid state arsenious acid may be detected by the following tests:

(1.) When heated on platinum foil arsenious acid produces a white vapour, and is entirely volatilized.

(2.) If some of the powder be heated in a small test-tube it will be sublimed, and small octahedral crystals, visible to the naked eye or by a lens, settle on the sides of the tube.

(3.) If arsenious acid be mixed with freshly burnt powdered charcoal, and heated in a small test-tube, a ring of shining metallic arsenic of a grey colour will be found on the cool portion of the tube, and an odour of garlic is perceptible.

If this deposit be heated it will become oxidized, and octahedral crystals of arsenious acid formed.

Further, the arsenious acid may be dissolved in distilled water and the liquid tests applied to the solution.

In solution arsenious acid may be detected by several tests. The solution of it in water is colourless, almost tasteless, and has a very slightly acid reaction. If a few drops be evaporated on a glass slide and examined by the microscope, numerous minute, and mostly imperfect, octahedral crystals of an amorphous deposit will be seen, presenting triangular surfaces by reflected light.

(1.) The ammonio-nitrate of silver (prepared by adding a few drops of liquor ammoniæ to a solution of nitrate of silver till the brown oxide of silver at first precipitated is nearly redissolved) throws down with arsenious acid a rich yellow deposit of arsenite of silver.

(2.) The ammonio-sulphate of copper (formed by adding liquor ammoniæ to a solution of sulphate of copper till the bluish-white oxide of copper is almost redissolved) produces a pale-green precipitate (arsenite of copper).

Care must be taken not to add too much of the test in the first instance, otherwise its blue may overpower the green of the precipitate.

(3.) Sulphuretted hydrogen water throws down a yellow deposit of sulphide of arsenic.

It is better, however, to use pure and well-washed sulphuretted hydrogen, generated in the usual manner.

In performing this test care must be taken that the liquid to be examined is not alkaline, or no precipitate will be produced, even though arsenic be present.

For this reason yellow sulphide of ammonium will not precipitate arsenic until acidified with a mineral acid.

There are several other processes for the detection of arsenic which are of great value, especially when mixed with foreign substances, viz.: (1) Marsh's process; (2) Reinsch's process; (3) the method for detecting the poison in an organic mixture.

Marsh's Test.—This test is founded on the fact that arsenious acid is decomposed by nascent hydrogen, forming arseniuretted hydrogen gas.

This vapour has the following properties:

It burns with a bluish-white flame, and gives off a white smoke (arsenious acid) which has an odour of garlic.

If a piece of glass or porcelain be held in the flame, a blackish metallic stain, consisting of metallic arsenic, will be deposited upon it. This stain might be confounded with one produced by antimony under similar circumstances.

Antimoniuretted hydrogen, however, does not burn with the odour of arseniuretted hydrogen.

The antimonial deposit is sooty, and has not a metallic lustre, and is darker than that of arsenic, which is of a browner hue. The arsenical deposit is, moreover, readily dissolved by a solution of chloride of lime (bleaching powder), whilst that of antimony is not affected.

To the stain may be added a few drops of nitric acid, which will be found to dissolve the arsenic.

If this be now allowed to evaporate, and the acid be neutralized, a few drops of nitrate of silver will give a brick-red precipitate of arsenate of silver.

Marsh's test may be carried out in the following way :

A flask is furnished with a cork, through which pass a funnel and a long test-tube drawn to a point, and the funnel is made to reach almost to the bottom.

Several pieces of pure metallic zinc are now introduced, and then some dilute sulphuric acid is passed through the funnel.

In this way hydrogen is produced, and escapes by the test-tube. When all the air has been expelled the gas should be ignited as it escapes, and a piece of cool porcelain held over the flame.

If there be no deposit, it is plain that neither the zinc nor the sulphuric acid contains arsenic.

A portion of the suspected fluid is next introduced into the flask by the funnel, and the escaping gas again tested.

Should a stain, giving the characters alluded to above, be produced, the fluid contains arsenic in some form or other.

Reinsch's Test.—The liquid suspected is boiled with one-sixth to one-eighth of its bulk of pure hydrochloric acid, and a bright slip of metallic copper is introduced.

If arsenic be present, the copper will be coated with it in the form of an iron-grey deposit.

The copper should be removed, washed with distilled water, and dried between the folds of blotting-paper cut into slips; it should then be placed in a dry tube and heated.

If arsenic be present, arsenious acid will be sublimed and deposited on the sides of the tube in the form of minute octahedral crystals.

These may be dissolved in water and tested in the usual way. Before applying this test, the hydrochloric acid, as well as the copper foil, must be examined, to make sure of their purity.

This is easily effected by boiling the copper with a mixture of the acid and distilled water before adding the suspected liquid.

Method of Detection of Arsenic in an Organic Mixture.—We think the most satisfactory method of detecting arsenic in an organic mixture is to boil up the suspected matter with a large quantity of pure strong hydrochloric acid. The mixture is afterwards filtered, and the arsenic is precipitated by passing a current of sulphuretted hydrogen through the filtrate. The arsenic is then thrown down as sulphide, and it may be estimated in the usual manner.

Treatment.—The chemical antidotes which may be given in acute arsenical poisoning are hydrated sesquioxide of iron, or hydrate of magnesia.

In acute cases, hot rugs should be applied to the abdomen.

Stimulants may be freely given every two or three hours.

Mucilaginous drinks of linseed and oatmeal gruel, and albuminous fluids, may be given with port wine or brandy.

In the treatment of chronic arsenical poisoning great care is necessary. Vegetable and mineral tonics, especially iron, with good nutritious diet, should be administered internally.

LEAD POISONING—PLUMBISM—SATURNINE EPILEPSY—LEAD PALSY.

Lead poisoning is generally confined to certain districts where lead-smelting is carried on, but it may also occur in horses from ingestion of lead paint and splinters of bullets which are scattered about near rifle-targets.

The lead contained in paint, when ingested, is acted upon by the gastric juice, and being thus converted into soluble salts is absorbed into the system.

In its pure metallic form, lead appears to be devoid of toxic properties; and it is well known that in the form of shot it is used by dealers of low principles to alleviate the symptoms of broken wind in horses they wish to sell. Some of the metal, however, is very probably converted into soluble salt, and being absorbed, becomes incorporated with the tissues.

In some instances lead poisoning has been due to boiling food in vessels used for containing lead preparations.

It is probable also that lead may be absorbed by water conducted through leaden pipes, and this is more especially likely to be the case, when the water is highly oxygenated, or contains organic matter.

Polluted shallow well-waters are more dangerous in this respect, because they act on lead violently and continuously, and therefore leaden pipes should never be used.

Lead when absorbed into the system leaves very slowly, and may be retained many weeks after the animal has ceased to ingest it in its water or food.

Lead poisoning may be acute, when it is sometimes spoken of as 'saturnine epilepsy,' in which coma, delirium, or convulsions are manifested, or it may be chronic.

ACUTE LEAD POISONING.—After ingestion of a large amount of lead, the appetite becomes impaired; there is copious discharge of saliva; the mucous membrane of the conjunctiva is injected; the animal is dejected, and sometimes the tongue is protruded.

The limbs are often drawn under the body; the head is depressed; the back is arched, and the coat may be rough and staring.

In some instances the animal speedily becomes comatose, while in other cases he is very violent, dashing his head about wildly.

Spasmodic contractions and twitchings of the muscles are often developed.

The breathing is quickened and difficult, and the temperature is usually somewhat elevated. The pulse is sometimes accelerated, and the artery hard and the volume diminished, while in other instances the frequency is not increased and the volume is fuller.

The bowels are usually constipated, but there may be diarrhœa and fœtid stools.

Pain is often, but by no means always, manifested.

In Wales, roaring is said to be the first symptom of lead poisoning in the horse.

CHRONIC LEAD POISONING. — The symptoms of chronic lead poisoning are produced by the ingestion of lead in small quantities over an extended period of time.

This form of poisoning is chiefly met with in the neighbourhood of smelting works, where particles of lead or its salts are disseminated over the grazing pastures, and also probably where lead enters the system through contaminated water-supply.

We are not aware whether any cases proceeding from the latter cause have been described, but some time ago a suspicious case came before our notice.

The appetite is impaired, and the coat becomes unhealthy, rough, and staring. The bowels are irregular; sometimes constipated, sometimes loose.

In most instances a peculiar blue line is observed on the gums where the teeth are implanted; but in the parts between the teeth this line is not present. This symptom is mostly regarded as diagnostic, but sometimes it appears to be very faint or absent.

Roaring is a symptom generally present, and is probably to be attributed to a paralytic condition of the nerves supplying certain muscles of the larynx (*vide* 'Roaring'). The muscles often twitch and contract spasmodically.

Difficulty of locomotion and paralysis, especially of the hind-limbs, are also liable to become developed in chronic poisoning by lead.

Sometimes the joints become swollen and the flexor muscles of the fore-limbs contracted, probably from paralysis of the extensor muscles of the limbs.

The animal thus appears to stand on its toes, and when it walks, it seems to knuckle over on the fetlocks.

The paralysed muscles may undergo atrophic and degenerative changes.

Diagnosis.—Acute lead poisoning may be mistaken for gastric and enteric disorders, accompanied with paralytic symptoms.

In lead poisoning, however, the muscular twitchings and fits are more frequent and more distinctive. The tucked up condition of the abdomen, the discharge of saliva, and the grinding of the teeth are also features indicative of poisoning by this substance.

In the chronic form of poisoning, which may be mistaken for articular rheumatism of a severe type, the paralytic features, the irregular recurrence of muscular twitchings and spasmodic contractions, as well as the 'blue line' when formed, are sufficiently indicative.

In articular rheumatism, the character of the local swellings and the tendency to metastasis, as well as the acute pain and its persistence, are diagnostic symptoms.

Morbid Anatomy.—*In Acute Cases,* the muscles are found both in a softened and blanched condition. The lungs and trachea are often inflamed. The mucous membrane of the alimentary tract shows alteration of structure, and is sometimes softened and pulpy over a considerable area, owing to infiltration into the sub-mucous layer.

Sometimes in parts there are blood extravasations of variable size and extent. The muscular tissue of the heart is softened and flaccid.

Ecchymosis under the endocardium is not present, whereas in acute arsenical poisoning, it is, we believe, *almost invariably found after death.*

The membranes of the brain are often congested.

In Chronic Cases the mucous membranes of the intestines and stomach present patches of ecchymosis and the cæcum and colon often show gangrenous patches.

The swellings in connection with the joints are composed of a collection of clear fluid outside the joint cavity.

Method of Detection of Lead.—The presence of lead in solution may be demonstrated by:

(1.) On passing sulphuretted hydrogen through it, or on adding a few drops of sulphide of ammonium, a black precipitate is formed.

(2.) A white precipitate results from the addition of liquor potassæ or liquor ammoniæ.

(3.) Dilute sulphuric acid gives a similar precipitate, which is insoluble in nitric acid.

(4.) Iodide of potassium gives a bright-yellow deposit (iodide of lead).

Method of Detection of Lead in the Tissues or the Urine.—The tissues should be dried and incinerated in a porcelain vessel.

The ash should be heated with a small quantity of strong nitric acid, and then evaporated to dryness. The nitrate of lead thus formed may be dissolved out of the residue by water, and filtered.

A portion of this liquid, evaporated on a slide, will yield crystals of nitrate of lead, which may be identified by:

(1.) Covering them with a solution of iodide of potassium, when they acquire a brilliant yellow colour.

(2.) Turning black on the addition of ammonium sulphide.

The remainder of the liquid, after filtration, may be treated with a current of sulphuretted hydrogen gas.

A brown colour or a brown precipitate, not readily dissolved by nitric acid, indicates the presence of lead.

The metal itself may be obtained, if necessary, by plunging zinc into a portion of the acidulated liquid (Taylor on Poisons).

Absorption of Lead.—Concerning the absorption of lead, in acute and chronic poisoning by this substance, Dr. Taylor says both in acute and chronic cases the metal, in some form, is found more or less in all the soft organs of the body.

The blue line on the gums affords an instance of its deposition in these parts, the colour being probably due to the conversion of the deposited lead into sulphide.

Lead was found by Tiedemann in the blood of poisoned animals; and Professor Cozzi found it in the blood of a person labouring under lead colic.

The urine appears to be the great channel of elimination; and Taylor found traces of it in the milk of a cow poisoned by lead paint.

Dr. Letheby, in a case of chronic poisoning, detected lead in the brain, muscles, and intestines, as well as in the blood and serum found effused into the ventricles of the brain; but none was discovered in the bile or urine.

Dr. Inman detected it in one case in the cerebellum.

M. L. Orfila states that he found it in the tissues as long as eight months after the withdrawal of the poison; and the facts connected with the slow disappearance of the blue line from the gums, on poisoning with this metal, render it probable that it may be detected after the lapse of one or two years.

Treatment.—In cases where the symptoms are rapidly developed from the ingestion of lead from paint or bullet-spray, it is best to administer such agents as enter into combination with lead, forming insoluble salts.

With this view, sulphate of magnesia, or soda with sulphuric acid and sulphur, may be given.

Lead sulphate, which is the most insoluble of all the salts of lead, and lead sulphide are thus formed. Being insoluble, these salts are therefore not absorbed.

If there be much pain, opium and hyoscyamus may be given also.

Should the pain continue, woollen cloths wrung out from hot water should be applied to the abdomen, and hypodermic injections of morphia may be administered.

The sulphuric acid should be repeated every three or four hours for two or three days, in order to prevent the solution of the remaining lead by the gastric juice.

The bowels should be kept in a lax condition by the administration of saline purgatives for a few days, and diluents may be freely given. In addition, the kidneys may be acted upon by the addition of nitric ether, or other mild diuretics.

After a day or two, tonics, such as gentian, quinine and nux vomica, may be regularly given.

In the chronic forms of lead poisoning, where this agent has accumulated in the system, a moderate dose of some purgative should be given in the first instance, and this should be followed up by the administration of potassium iodide.

The iodide, after its absorption in the blood, combines with the lead and forms iodide of lead, which, re-entering the circulation, is eliminated with the urine.

The dose of iodide should be small at first, as when it combines with the lead the phenomena of acute lead poisoning may come on, from the large amount of iodide of lead formed and passed into the circulation.

In some cases of valuable horses, if paralytic symptoms remain, galvanism may be tried, as in man.

In all cases of lead poisoning it is of the first importance that the animals be moved from the source whence this agent is derived.

ANTIMONY POISONING.

Antimony is occasionally administered to the horse in the form of tartar emetic, or as chloride or butter of antimony. These salts are not nearly so frequently given as they once were, and the practice, we believe, is now considerably on the decrease.

The symptoms are those of an irritant rather than of a corrosive poison.

There are frequent attempts at vomition, and in some cases this is complete.

In severe cases the pulse becomes weak and fluttering, and almost or quite imperceptible.

There is great prostration and gradual loss of consciousness in severe cases, followed by death.

YEW-TREE FOLIAGE.

Many instances of death from browsing on the leaves of the yew-tree (Taxus Baccata) have been recorded in the horse.

After death, which in some cases took place from two to three hours after the ingestion of the foliage, the stomachs were found contracted and inflamed.

Method of Detection.—Fragments of the leaves or the berries may be found in the stomach after death.

The apex of the leaf of the yew is not so pointed as that of the savin; and the yew-leaf does not possess the peculiar odour of savin when rubbed.

Yew-berries are of a bright red colour, and green at the top, allowing a hard brown kernel to be seen.

The juice, which reddens blue litmus paper, has a nauseous sweetish taste.

Treatment.—The method of treatment to be adopted is the internal administration of oleaginous purgatives and diffusive stimulants, such as the aromatic spirit of ammonia and nitric ether in linseed gruel or water.

CORROSIVE SUBLIMATE

Is sometimes given in injurious doses, causing loss of appetite, salivation, pawing, looking at the flanks, rolling, profuse perspiration, rapid, weak, thready pulse, violent purging, tenesmus, convulsions, and death.

After death the stomach is much inflamed, and in patches intensely so.

The whole intestine is likewise inflamed, and gangrenous in patches.

Antidotes, as white of egg mixed with water, or thick starch or arrowroot, may be given.

HELLEBORE.

Black hellebore, or the Christmas rose, and white hellebore, or veratrum album, are both poisonous when administered in large doses.

The action of the latter is similar to that of the former, but is more irritant.

Hellebore is occasionally administered by grooms to horses under their charge, as they suppose it to have a valuable alterative effect.

Symptoms.—In a case recently under treatment by us, two drachms of the pulverised root of the white hellebore were given by the groom to a carriage horse.

When called in, the head of the animal was protruded; the pulse was much accelerated, and varied from 90 to 100 beats per minute; the respirations were considerably quickened; the extremities were deathly cold, and there was marked nausea, and frequent attempts at vomition. The appetite was completely lost for forty-eight hours, after which it gradually returned, and the animal made a slow, but complete recovery.

The late Mr. D. Gresswell, who had a large number of cases of poisoning by hellebore under treatment at different times, observed complete vomition in some instances, and was of opinion that if given in large doses this drug generally causes actual sickness.

Method of Detection of Hellebore.—Powdered white hellebore-root has a reddish-brown colour resembling jalap.

Nitric acid turns it a red colour, rapidly passing to a dark brown.

Iodine water gives it a bluish-grey tint, which is only slowly brought out. Sulphuric acid turns the powder to a brown-black.

Diagnosis.—Hellebore poisoning is very frequently mistaken for choking by the uninitiated; but the history of the case, when that is to be obtained, and the character of pulse, will at once clear up any doubts.

Treatment.—A good moderate dose of some aperient medicine should be given in the first place, and this should be quickly followed up by the administration of stimulants and tonics.

The diet should be moist and nutritious.

After recovering from the effects of the poison, tonics should be administered for a week or two.

The following remarks are taken from a paper on 'Hellebore Poisoning' in the *Veterinary Journal* for 1886, vol. xxii., pp. 240, 241:

'While we may be consoling ourselves with the fact that poisoning by arsenic, antimony, and mercury is far less common among horses than it was some few years ago, it is very disheartening to find, from experience, that vegetable toxic agents are more largely administered than ever to the animals to whom man owes such a debt of gratitude. To what can we attribute such wanton, wilful ignorance, such gross cruelty, such ingratitude? To superstition, to quackery, and to carelessness of consequences, we reply. Poisoning by aconite is on the increase in many parts, and more than counterbalances the diminution of cases of poisoning by arsenic.

'It is not, however, our purpose to-day to enter into details concerning aconite-poisoning in horses. It is too well known to need repetition. To-day it is my intention merely to describe a case of marked hellebore poisoning which would have proved rapidly fatal had professional advice not been obtained.

'On March 6th, I was summoned to a heavy draught horse, said to be choking. The symptoms observed by the owner had supervened three hours after the administration of a ball containing a large quantity of hellebore (*Veratrum album*).

'It is, perhaps, almost needless to add that on my arrival nothing whatever was told me concerning the ball, which had been given with the view of curing the grease from which the horse was suffering. This had to be elicited by close cross-questioning, by which it was discovered that the balls had been procured from a duly-qualified chemist.

'I found the animal retching continually, but there was no actual vomition. The pulse was very irregular and feeble, and numbered eighty-six beats in the minute. The respirations were sixty-eight. The symptoms had been gradually becoming more severe, until, when death seemed imminent, my advice was sought. Three ounces of whisky, with three ounces of solution of carbonate of ammonia, were ordered to be given every hour for six times, and then every two hours. In twelve hours' time the animal began to improve. On the following day he was much better, and tonics were substituted for the stimulants. The horse then rapidly recovered, and to-day (March 8th) is perfectly well. It is noteworthy that in some old *popular* works on the veterinary art overdoses of white hellebore are recommended for the treatment of certain complaints, and it is unfortunate that, as yet, there is no thorough popular work on the diseases of the horse which, while teaching horse-owners the ordinary facts concerning simple diseases and simple remedies, can in any degree be said to be reliable. The populace must have some knowledge of the veterinary art before its value can be thoroughly and fully appreciated.

'Especially is there a need that the simple diseases of the horse should be popularly treated of, as the so-called knowledge of them is in reality no knowledge at all, but the grossest ignorance. This is not true, however, with regard to the science and art of equine surgery, as there is no doubt that the general run of intelligence in this subject is far greater than in equine medicine.'

OPIUM.

Opium poisoning is of rare occurrence in the horse.

This drug, however, is sometimes administered by dealers and others in order to prevent kicking and restiveness in horses they wish to sell.

A few weeks ago we were called in to see a black mare, aged eight years, to which the owner had administered one ounce and a half of Turkey opium.

When called in, on the day following the administration of the drug, the mare was found to be in a very dull, dejected condition, and the pulse was very feeble and soft, and the artery very compressible. The number of beats was 84 per minute, and the temperature reached 102·5°.

The pupils were contracted, and there was total loss of appetite, the mare refusing all food and drink. The breathing was slow, but not stertorous, and the nasal mucous membrane was of a dark brownish hue.

The symptoms remained unabated for three days, during which time the animal continually moved round and round in the box. On the fourth day the pulse began to regain vigour; but recovery was not complete before the lapse of a week.

SAVIN

Is sometimes given by grooms and others, with the idea of improving the condition, and has often caused death.

It is said that the presence of savin can best be detected in the stomach of the horse by the black currant-leaf-like smell of the contents when boiled in a little water or beaten up in a mortar.

When seen under the microscope, the leaves have sharply acuminated apices.

BRYONY.

Bryony (*Bryonica dioica*) is often given by horse-breakers to young horses, with the idea of improving the condition.

Although this drug excites the animal, and for a time is said to improve its condition, it is nevertheless decidedly poisonous; and when the transient effects are over, depression of energy and corresponding loss of condition follow.

WATER DROP-WORT.

The water drop-wort (*Œnanthe crocata*) is a plant commonly growing in ditches and marshy localities. This plant is not often eaten by horses; but brood mares, with appetites vitiated by their being in foal, have been poisoned by eating it.

As antidotes, vinegar and gruel are recommended.

EUPHORBIUM.

Euphorbium, or spurge, is one of the ingredients in the farrier's blisters, and has caused many deaths from the great irritation which it has set up.

CANTHARIDES.

Cantharides, or the Spanish fly, is sometimes administered as an excitant to the horse and mare at the breeding season, and, owing to the large amount given, has been the cause of many deaths.

It is said that a drachm, and, indeed, sometimes a much less amount, will kill almost any horse.

The drug, which is a purely irritant poison, is administered in the pulverized condition in the form of a ball, or as the tincture.

When given as a ball, some portions of the fly may often be detected as little glittering particles which are apparent on the sides of the fæces in hot water.

In cases where cantharides has been inadvertently or wilfully administered in too large doses, oily and demulcent liquids may be given in large quantities.

CHAPTER XIII.

CONCLUSION.

THE following remarks on 'Progress in Veterinary Science,' by ourselves, we take from the *Veterinary Journal* for 1886, vol. xxiii., pp. 169-171:

'The errors connected with various departments of veterinary science which are rampant in the public mind, though far less numerous and cogent than in former days, are still exceedingly productive of mischief. So much knowledge has been already gained, and so much good has been done in recent years, that one can only marvel how it is there are so many fountains of ignorance still almost untouched. Food for reflection is amply supplied by the contemplation of the past history of all science, and in the field of comparative pathology especially are we able to observe that very much earnest work, and very many active and energetic inquirers, are needed. The worst tendency in the human mind is, perhaps, that which leads men to pursue old methods, and to adhere to old ideas without attempting to advance and progress. In order to obviate such tendencies, fresh blood is continually required. New and original men must be found and encouraged. Again, much must be done to educate the great mass of the people, whose seething ignorance of the laws of science, and especially of hygiene, is appalling. This can only be done by the cultivation of the literary spirit and power.

People will not read, and we cannot expect them to read, that which they cannot easily understand. Unfortunately, as a rule, scientists do not usually write so as to be comprehended easily, even by fellow-workers in their own department of inquiry. There is a good deal of what may be called scientific pomposity used in ordinary scientific literature. The fact is, as Huxley says in one of his works, "It is far more difficult to write popularly on abstruse subjects than to write about them in the ordinary scientific language." Thus it appears that the sarcasm which is sometimes indulged in against those who write scientific books, for the purpose of meeting the requirements of those who have scarcely read deeply on scientific subjects, is very greatly misplaced. On the contrary, men ought to try rather to educate those who have had no special culture in scientific methods and pursuits. There is no doubt that very much valuable matter is lost to the world for want of those who could make it available, had they the necessary power to do so. Unfortunately, it often happens that men who know important facts will not take the trouble to record them. Let it not be imagined that we ignore the work of the past. There can be no doubt that there is a great deal of arrogance in these days which refuses to acknowledge much good work. Many men do work which is only appreciated after their death. In fact, few great men can be said, like Wagner in one field of work, and Pasteur in another, and Herbert Spencer in a third, to reach popularity in their own time, and even such men as these only advance a little towards the zenith of their fame. The fact is that really great work requires so much labour, so much time, so much unrequited and unacknowledged effort, that it is almost impossible to reap the full rewards, the finishing touches, the end results in a man's lifetime.

'With regard to enduring work in the field of comparative pathology, one thing is certain, and that is, that veterinary science must be far more generally acknowledged as of primary and essential importance before we shall be able to see how true it is that the only true science of pathology is that which rests on comparison. Comparison, the method used in all the other sciences, must *a fortiori* be used in the most difficult of all—that of pathology; and if we, in this day, wish to carry on and succeed in advancing to its great and almost infinite possibilities the new science, we must above all things grasp in their entirety the new ideas, and work them out fully and with a master's care. In order to popularize veterinary science, much must be done in trying to talk to the people about it. They must be led to acknowledge the importance of it, to see how it bears on human medicine and surgery, and is but little less complex; they must be taken kindly by the hand, and taught to see what is known about disease, and about its causation, curability, and prevention—all this must be done, and done well, too, before the public will look up, as they will in the future, to the veterinary surgeon as the cultured comparative pathologist, and investigator into one of the most interesting and most essential of scientific pursuits.

'And it is clear that the general practitioner of human medicine must attain some knowledge of the diseases of animals, as well as of man, before he is able to thoroughly understand morbid phenomena in general, and to make generalizations upon which a system of rational therapeutics may be based. In short, comparative pathology is the science of the future, and if the veterinary surgeons of this day work at it thoroughly and well — as, indeed, they have excellent opportunities of doing—they will have much more to teach to their brother scientists than they have yet done; and, in consequence of their knowledge, they will be looked up to as workers in one of the most important of all departments of scientific research.'

We now conclude with some remarks from the pen of Dr. Albert Gresswell, D.M., M.A., Christ Church, Oxford, M.R.C.S.:

The rules and the reasonings of common-sense admit of almost indefinite expansion, and we find that the result of an extension of the universal law that every cause must have an effect, and, inversely, that every effect must have had a cause, could we but trace it, does, as a matter of fact, lead us to that belief in evolution which, having previously been recognised in every other department of human inquiry, has at length also been admitted to hold, even in the last strongholds of empiricism, the domains held by the monsters Disease and Death. For some time it has been held that the universe, together with all its multifarious contents, has gradually been developed from the simplest forms of matter of a primeval past. The life-work of Charles Darwin, coupled with that of other writers and investigators, such as Herbert Spencer, added the link of vital phenomena to the chain of thought, which was previously incomplete. Now one more link has been hinted at, it is for the observers of this age to rivet it; and we must not forget that the difficulties which will be experienced by those who try to effect this will proceed rather from a superabundance than from any deficiency of the facts to be gathered together into one unique whole. Those who attempt to trace the idea of evolution throughout the mazes of pathology will have before them a gigantic task, but yet one which most urgently requires to be fulfilled.

There are so many different points of view from which the subject can be regarded that one may be apt, while insisting upon one or other aspect, to lose sight of the rest. The great thing is that in our investigations we should never put out of mind the essentials of our pursuit, that we should never be content with having traced our subject backwards, until we have actually grasped the very root of the matter, so far as our human intelligence can enable us to do so.

Now, the theory of evolution is nothing other than a perfection, or rather, perhaps, an amplification, of the ordinary human methods of reasoning, and, consequently, it will, of course, be applicable to all groups of facts when they are thoroughly understood. Granted that there must be in all things an unknown and unknowable factor, which we cannot discuss even cursorily in this connection, since it would draw us away much too far from our subject to do so, we must never rest content with any explanation of a thing or things until we have cleared the ground of every other ascertainable factor; and the degree to which we succeed in doing this will be a measure of the thoroughness of our investigations. To those who would object to the theory of evolution, that it is not complete, because it does not give a thoroughly intelligible explanation of the actual basis and reality of things, it is to be replied that it achieves the next best object to this, viz., the highest provisional *rationale* which the mind of man has grasped. Indeed, it may be said to be a universal law of causation. Naturally it was first recognised where most easily perceived, and only in quite recent times has the idea of definite causation been traced into the sphere of vital actions, a sphere which necessarily was at first replete with doubt and mystery. In view of the mass of evidence now at our disposal, it may be said that although the theory does not always strike us as being in complete accord with all the observed and multifarious facts of life, yet, nevertheless, the closest examination of difficult points will invariably reveal that what aspects of life are involved in the folds of the inexplicable are certainly of no greater magnitude than are the other equally inscrutable mysteries presented by many of the inanimate aggregates existing in the universe. In other words, it may once for all be admitted that, so far as the need for explanation of their origin and existence is concerned, living beings cannot now be looked upon as offering greater difficulties than do the heavenly bodies, for instance. No doubt at first sight the various processes displayed by living organisms are apparently more wonderful than are the other kinds of phenomena presented on all sides to our consciousness ; but in proportion as by studious investigation we gradually become more and more familiar with life as displayed by the innumerable living things around us in earth, sea, and sky, the great question cannot but present itself whether the marvellously-regulated motions of the heavenly bodies, and even the bare existence of them throughout the starry spaces of the heavens, is in essential reality one whit less wonderful than is the conscious existence of any human being. In short, the systematic explanation of all things according to the idea of a gradual evolution of them, *i.e.*, according to a universal law of causation, is a very great advance in our methods of reasoning on the erratic and confused conceptions which were formerly held in respect to the phenomena occurring around us. Furthermore, it must be sufficiently obvious that, since changes or functions displayed by organisms which depart so far from those of health as to be called abnormal can only be classed as part and parcel of the sum total of processes manifested by them, they, too, can have no other than a similar relative explanation.

Hence it follows that the idea of evolution in the field of pathology is in reality not only to be accepted in itself as unquestionably true, but is rather to be accounted as one of the supports of evolution at large. If it is true that the numerous and involved processes which make up healthy life in all its many varied forms and phases are to be considered in connection not only with one another, but also with the phenomena from time to time occurring in the outside world, it is also no less true that the general statement applies with just the same force to the phenomena presented by creatures suffering from disease, as it does to the normal functions of healthy living beings.

We hope that we have, in some degree at least, succeeded in pointing out some few facts of disease which will bear out this statement, and also in attempting to indicate causation in some instances where at first sight even connection may not be easily traced. It is, however, sufficiently manifest that, though we can to a large extent say definitely of many given structures and functions that they are either normal or abnormal, as the case may be, there are instances in which it is extremely difficult to draw the line of demarcation, and it is quite evident that the same law of causation which we suppose to be applicable to the one group applies with equal force to the other. If a structure is disorganized, or a function vitiated or altered, there must always be a cause, could we but trace it, for the change which has resulted. The origin of the alteration may be ever so remote. We may possibly have to look back to a far distant point of time, to progenitors of a bygone age. Still, the cause has existed in some form at some time.

Perhaps one of the most important of all the possible indications concerning pathology is that the various diseases and disorders which are liable to afflict human beings present relationships with those of lower animals, just as, indeed, other human characteristics, whether structural in nature or functional, are likewise related in certain ways to those of organisms lower in the scale of vitality. Even now the evidence which supports this generalization is very strong indeed, although the science of pathology has as yet been only cursorily studied from the comparative point of view. As yet men have scarcely learned to fully realize the incalculable advantages capable of being derived from investigating the diseases of human beings by the help of the light thrown upon them by the normal and abnormal processes presented by lower animals. Nevertheless, already it is the case that many talented pathologists are beginning to track out new paths leading to fertile regions, and now is the time for very many more earnest and zealous workers. There are, indeed, immense stores of knowledge to be gained, and many fruitful opportunities are available for all those investigators who are desirous of throwing more light on the many abstruse problems presented by disease. This present time is one of transition, and many of our ideas as to the processes of life, both well ordered and disordered, will probably be ere long very essentially modified and changed. The mysteries of life, disease, and death, are now being marvellously cleared up. We are beginning to see things in their truer light, and to understand that gradual working, in accordance with necessary causation and connection, is the *rationale* of *all* that goes on around us.

And now, in conclusion, let us for a brief moment cast a swift glance backwards at the glorious history of science. How clearly does it appear, when we do so, that its gradual but sure growth in accordance with all the co-operating factors, and also in most intimate correspondence with all those various involved conditions to which man's intellectual powers have been, and are being, subjected, furnishes in itself one of the very best of all those innumerable examples which we can adduce in illustration of the general process of evolution. With exceptional force does this statement apply to the science of comparative pathology, a science even now in its earliest infancy. Indeed, it is only most recently that the gradually increasing firmness of the establishment of the doctrine of evolution as a relatively true, real and indispensable fundamental basis of thought and fact has led men to inaugurate their initial attempts to unravel by its aid the intricate clues to the varied and at first sight most mysterious phenomena of disease. The discovery of modern microscopic methods has concurred to help the tide of progress in medicine to a marvellous and well-nigh incredible extent. Indeed, in the field of pathology, the advances made during this present century, now about to close, have been truly wonderful in magnitude and far-reaching in importance. Yet wondrous and great as they have indubitably been, these discoveries are probably almost as nothing when compared with the new developments of our knowledge which we may expect to be made ere long.

Probably the most important epoch of all epochs, so far as the world of medicine is concerned, may be said to be this present one, which has been marked by the promulgation of the germ theory of disease, and by its subsequent elaboration, which still proceeds, and will continue to proceed with yet more rapid strides. Indeed, it would be quite impossible to exaggerate the importance of the influence exerted by recent discoveries, both in reference to preventive medicine and to our knowledge of the best modes of treating the different disorders with which all human beings and animals are liable to be affected.

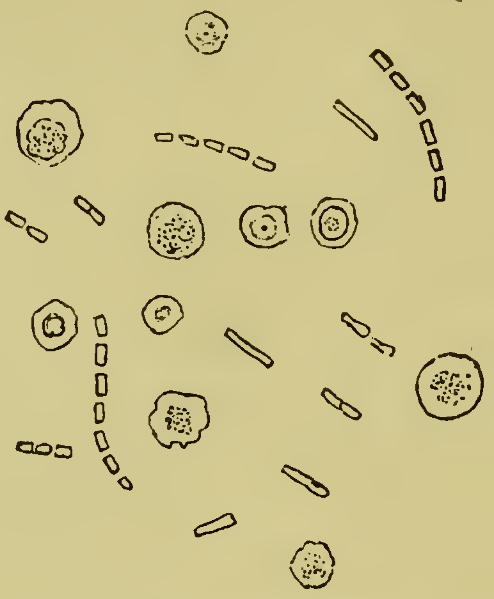
Day follows day, the years roll on, and as the wheel of time revolves it brings with it more and still more accurate information, which is furnishing an entirely new basis for the sciences of medicine and surgery as pursued by our predecessors.

The discovery of the power for good of vaccination, the recent establishment of the germ theory of disease, and of its numerous and weighty implications in regard to actual treatment, the employment of antiseptic measures, the inoculatory methods which have proved so highly successful in the hands of M. Pasteur, his co-workers, and others, certain most valuable new lines of medical treatment—all these initiations of quite modern times are very intimately connected one with another, and they open up quite a vista of unexplored regions. Just as the elaborate science of morphology has arisen out of the crude anatomy of earlier days, so must the true science of pathology be developed from the basis of our present knowledge, the starting-point from which we may see a dim vision of a goal.

As a provisional explanation of the mode of development of organisms, in the case of the tribe no less than in that of the individual, and in many other ways, the hypothesis of evolution has already been of incalculable advantage. The benefits hitherto derived are, however, immeasurably enhanced by the importance of the light now being thrown upon vital processes, both normal and abnormal, by those who are, whether consciously or unconsciously, now being guided by the idea of evolution in their methods of research. In every department of knowledge this theory is exerting the very greatest influence; but there is no science which is destined to be so profoundly affected for good by it as is that of comparative pathology, the true and rational science of disease.

In fine, it must be held a primary and fundamental assumption that, just as all animals have presumably had a common origin, in like manner all functional and structural disorders present connections of the very highest interest and importance one with another. In short, the phenomena of disease are to be studied from their comparative aspect, no less than by their special manifestations. This is a point of view which men of light and leading are now applying with the best results, and herein is opened out a new field for investigation, which in the very highest degree demands cultivation, on account of the wondrous usefulness of the knowledge which is to be gained thereby. Just as on the sea-shore the many and varied sounds of the storm-tossed ocean, rolling onwards to the sandy beach, may be heard as one harmonious and magnificent monotone of a wild and yet moderated symphony; just as other worlds around us play, with the earth whereon we live, mutually dependent parts; just as all things, though innumerable and infinite, yet partake of union and express a uniformity in Nature—so, too, do all things soever which come within the scope of human cognisance lend themselves, more or less completely, to simple and easily intelligible provisional modes of explanation.

And let us never falter or waver on our way upwards towards the great truths above us, and never rest contented unless we are climbing—it may be very toilsomely—over rocks and crags, and huge mountain boulders, and beside deep chasms and pitfalls, yet still always climbing upwards and onwards, higher and ever higher, higher and yet higher still.



THE GERM OF GLOSSANTHRAX EQUI.

My object in this note is merely to give the readers of this journal an illustration of the germ which has been found by us in cases of glossanthrax and anthracoid angina in the horse, and not to enter on this occasion into any discussion, seeing that as yet all Koch's conditions have not been fulfilled. The disease is rare in England, but is altogether unmistakable, the above illustration of Mr. J. B. Gresswell's, taken from a photograph, giving a general representation of the appearance of a horse afflicted with this disease. With purpura hæmorrhagica it could not possibly be confounded, nor could it be confounded with anthrax fever.

Treatment has seemed hitherto of but little avail in glossanthrax, though for anthrax fever perchloride of mercury and sulphite of sodium have proved of efficacy in many instances.

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